Are there similarities and differences in the content and process of clinical decision making by Biomedical Engineers, Occupational Therapists and Speech and Language Therapists when assessing for electronic assistive technology for adults with an acquired brain injury?

Taylor-Goh, Sylvia Margaret Eileen Josephine

Awarding institution:
King's College London

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Sylvia Margaret Eileen Josephine Taylor-Goh

2015

Thesis submitted to King's College London, in partial fulfilment of the requirements for the Degree of Doctor of Philosophy

Abstract

Electronic assistive technology (EAT) is prescribed by different professionals. Little is known regarding how these professionals make prescription decisions or their perceptions of their specialist knowledge and role in the assessment process.

Study Aims:

- to explore the participants' perceptions of their specialist knowledge and role (Study 1);
- to investigate the similarities and differences in the content and process of clinical decision making (CDM) during assessment and prescription of EAT for adults with an acquired brain injury (Study 2).

Design: A cross-sectional design employing concurrent think-aloud method and semi-structured interviews.

Methods: Two standardised case scenarios were presented to participants asked to think aloud their assessment of the patient (Study 2). A semi-structured interview followed (Study 1). Verbal data underwent thematic and analytic coding. The analytic coding underwent statistical analysis to explore the usage differences of the decision making processes between the professions. Decision process graphs (DPG) were drawn to explore whether there were patterns of use of the CDM processes according to level of expertise.

Subjects: A purposive sample of 60 participants (BE, *n*=20; OT, *n*=20; SLT *n*=20) from assistive technology centres and brain injury units across England.

Results: The CDM content was similar across the professions. The hypothetico-deductive model of decision making was used and two further stages, "cue implication" and "hypothesis implementation" emerged from the data. Patterns were observed in the DPG, which may be associated with differences in the CDM process according to levels of expertise. Participants' reported profession-specific differences in their specialist knowledge and role, which were not clearly evident from the Study 2 results.

Conclusions: The content and process of clinical decision making was similar across the three professions, though profession-specific specialist knowledge and role differences were reported by the participants. Level of expertise may affect the CDM process but did not affect the final prescription.

Acknowledgements

This thesis has been achieved with the invaluable assistance of a wide range of people. It is primarily the result of a collaboration with two outstanding academic supervisors, Dr Ruth Mayagoitia-Hill and Professor Sheila Kitchen who have been unwavering in their support and guidance. Ruth and Sheila have been incredibly generous in giving of their time and sharing their knowledge and expertise in the field of EAT and clinical decision making. Ruth has been a tremendous mentor over the years and I have learnt a lot more from her than would fit into a thesis. Sheila is gifted in asking probing questions and it has been a real joy to have also had her as a supervisor.

Sincere thanks must also go to the participants who gave up their time and were willing to share their experience of clinical decision making within the field of EAT.

A huge thanks is also extended to friends and colleagues who assisted in the development of the case scenario materials and in particular to Julia, who is not only an excellent physiotherapist but doubles up as an excellent simulated patient!

To Suzanne, Marilyn and Sharon: I am hugely grateful for the role you played as naive assessors and the hours you spent coding data.

And finally, to Patrick, Nathan, Adam and Bethany. You have been alongside me throughout and provided love, encouragement and much practical assistance, especially from Nathan! I owe you all an enormous debt of gratitude.

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List of Abbreviations used in this Thesis

AAC	Alternative and augmentative communication
ABI	Acquired brain injury
AT	Assistive technology
ATD	Assistive Technology Device
ATES	Assistive Technology Evaluation and Selection
BE	Biomedical engineer
CCT	Cognitive Continuum Theory
CDM	Clinical decision making
DM	Decision making
DPG	Decision process graph
EAT	Electronic assistive technology
ECS	environmental control systems
EU	Expected utility
HAAT	Human Activity Assistive Technology Model
HDM	Hypothetico-deductive model
ICF	International Classification of Functioning, Disability, and Health
IPT	Information processing theory
MPT	Matching Person and Technology
NHS	National Health Service
OT	Occupational therapist
PBG	Problem behaviour graph
SEU	Subjective utility theory

SJT	Social Judgement Theory
SLT	Speech and language therapist
TA	Think aloud or thinking aloud
VOCA	Voice output communication aids
VP	Verbal protocol

Chapter 1

Introduction to the Thesis

1.1 Introduction

This thesis sets out to explore the content and process of clinical decision making of biomedical engineers, occupational therapists and speech and language therapists during the assessment for electronic assistive technology. It also investigates their self-perception of their expertise, specialist knowledge and role. This chapter provides the context and background to assessment for electronic assistive technology within England as this was the setting for the study. The aims of this study and the organisation of the thesis are also provided.

1.2 Disability and Assistive Technology

Within Great Britain, government statistics from the Office for Disability Issues report that 11.2 million people, of whom 10.4 million are adults, "live with a longstanding illness, disability or infirmity, and who have significant difficulty with day-day activities" (ODI, 2012). The figures indicate a relatively even split between men and women (5.3 and 5.9 million respectively). In 2010/11, 6.4 million people had difficulty with mobility, 2 million with communication and 2.3 million with memory, concentration and learning.

Disability, as defined within the framework of the International Classification of Functioning, Disability, and Health (ICF) (WHO, 2001) is a complex multidimensional set of phenomena and reflects a combination of problems at the level of the person's body together with complex social phenomena. It encompasses problems with body function or structure, limitations when undertaking activities and restricted participation in life situations. Disability is always an interaction between the person and the context in which the person lives, which includes environmental factors such as the social, attitudinal and physical environment. It may have an effect upon their personal wellbeing which, in turn, may impact their quality of life.

Within this context, the use of assistive technology (AT) can have the ability to empower an individual to achieve a measure of independence and autonomy, which they may otherwise not be able to accomplish. A definition of assistive technology, which is widely used within the UK, was generated during a user group consultation at the King's Fund "a product or service designed to enable independence for older or disabled people" (King's Fund consultation, 14th March 2001). A definition by Scherer (2002) provides further detail and will be used within this study "any item, piece of equipment or product system whether acquired commercially off the shelf, modified or customized, that is used to increase, maintain, or improve functional capabilities of individuals with disabilities."

Electronic assistive technology is a sub-set of AT and within this study it refers to a range of technology with different applications including environmental control systems (ECS), voice output communication aids (VOCA) and computer access systems. An environmental control system enables remote control of home appliances with the use of a central controller using radio, infrared or wireless technology. A voice output communication aid can range in level of complexity from a device which produces simple single-messages using recorded speech to complex computer-based systems which use synthesized speech. Computer access may require the use of adaptive hardware and software.

1.3 Overview of Prevalence of Need, Service Provision and Funding Arrangements

Calculating the prevalence of persons requiring alternative and augmentative communication (AAC) was undertaken as part of the recent AAC review (CM, 2013). Prevalence was estimated by combining the figures acquired from deduction of the prevalence from existing literature, inspection of the General Practice Research Database and the English Health Survey data sources in addition to consultation with experts. The results indicated that as an estimate, 0.5% of the UK population requires some type of AAC, which equates to 529 people per hundred thousand population. It was estimated that 0.05% of the population requires a high-tech communication device, and as the average known use was 0.014% it suggests that fewer than a third of those who could benefit have access to such technology. It is estimated therefore within England whose population in 2012 was 53.5 million (ONS, 2013), 267,500 people may require AAC, of whom 26,750 may require a high-tech device.

The structure of service provision for EAT is varied throughout the UK with different funding arrangements in place for provision of AAC and ECS technology. Within the UK funding for AAC is complex and disjointed with no ring-fenced statutory funding available for communication aids for the adult population. The Government's Integrating Community Equipment Services document (DoH, 2001) stated that provision of communication aids was underdeveloped and that some of the additional funding being placed into equipment services was to be made available. Access to such funding was fragmented within the UK, resulting in unequal provision. With specialist voice output communication aids (VOCA) often costing in the region of £200-£10,000 per device, adults requiring a communication aid have therefore been required to self-fund, apply for charitable funding or present their case to their local primary care trust or acute hospital trust in order to seek funding. Within the previously reported AAC review funding arrangements was the most commonly reported concern amongst service users, communication partners and professionals (CM, 2013). In April 2013 new legislation was introduced whereby the NHS Commissioning Board assumed responsibility for commissioning specialised NHS services in England (including AAC) with the aim of creating a single, national approach (DoH, 2012-2013). It adopted the recommendation from the Office of the Communication Champion and Council for a hub-and spoke-model of AAC service provision (Council, 2011) in which the regional hubs would undertake specialised assessment procurement and support local services.

A national procurement process exists within environmental control services where there is a national NHS Assistive Technology contract with suppliers. There is therefore, no burden on service users to seek funding for this equipment.

1.4 Structure of Assistive Technology Services

Within England, specialist electronic assistive technology services may be provided by the NHS or by charitable foundations. The NHS Commissioning Board 'Manual for prescribed specialist services' (NHS, November 2012) states that there are between 20 and 25 services providing ECS, 12 of which are considered major providers and cover 70% of the population. There are 10-12 specialist AAC centres of which at least eight also provide ECS.

People requiring specialist assessment at an EAT service may have a combination of physical, sensory, communication, cognitive and learning disabilities. It may be that a technology solution for them is a single system or they may require multiple technologies, which may be integrated into a single means of access and functionality. For example they may have a wheelchair-mounted integrated ECS, communication and computer access system.

Assessment models and services often differ but most are staffed by a multi-disciplinary team (either based together or at different sites) which may include any of the following professions:

i. biomedical engineer, clinical scientist, clinical technologist, rehabilitation engineer, assistive technologist or equivalent
ii. occupational therapist

iii. physiotherapist
iv. rehabilitation consultant
v. speech and language therapist
vi. teacher

Members of the team may carry out an assessment for the provision of an environmental control system, communication aid and specialised computer access. Assessment is of key importance as abandonment of AT is common for a number of reasons (Phillips and Zhao, 1993, Scherer et al., 2005, Verza et al., 2006). Phillips and Zhao (1993) report that productive use of EAT is dependent upon successful implementation and that the primary reason for discontinued use of AT is a breakdown in the delivery of service which includes installation, training and review. Additional factors often associated with discontinuation of AT use include social acceptability of the technology (Hocking, 1999) and the influence of the cultural perspective (Ripat & Woodgate, 2011). In common with all aspects of healthcare provision, the financial costs associated with AT are an important consideration in service provision. Additionally the potential reduction in social costs and the increase in quality of life (Andrich and Caracciolo, 2007) associated with successful implementation are important outcomes of AT provision. As the provision of environmental control systems has been available since the 1970s as an NHS prescription item and procurement was devolved from the Department of Health to NHS health regions in 1995, NHS services can prescribe and install such systems. With the recent change in legislation noted in the previous section, a similar process may become available for communication aids. Currently, it is unlikely that the services have the resources to provide communication aids or computer equipment, although some may have a bank of devices available for short-term loan. The recent review of AAC reported that a specialist AAC service should provide: assessment, equipment for trial, provision of a powered aid, maintenance, customisation of equipment (particularly hardware) and training of professionals. It also reported a wide variation in service provision across the UK with no consistency in the elements of service provision within the specialist and local services (CM, 2013). Enderby et al. (2013) concluded that the components required for effective AAC provision include assessment, information and advice, loan to trial the device, positioning and mounting, customisation, funding, maintenance, repair, review of needs, support, integration, research and development.

1.5 Aims of the Study

The aims of this study were:

i. to explore the participants' perceptions of their specialist knowledge and role in the assessment of EAT (Study 1);

ii. to investigate the similarities and differences in the content and process of CDM during assessment and prescription of EAT for adults with an acquired brain injury (Study 2);

The subsidiary aims were:

i. To examine whether there are differences in CDM:
   a. between disciplines;
   b. between specialist assistive technology centres and non-specialist centres;
   c. between experts and novices.

ii. To explore the different theoretical models of CDM in relation to EAT assessment.

1.6 Organisation of the Thesis

Chapter 1 sets out the context within which clinical decision making occurs in the field of EAT within England. It summarises the provision of EAT and outlines the structure of assistive technology services. The aims of the study are provided.

Chapter 2 reviews the literature in relation to the assessment for EAT and clinical decision making, including the methodologies employed.

Chapter 3 present a justification for the methodology undertaken for Study 1 and primarily Study 2.

Chapter 4 outlines the methodology for Study 1 which investigated the specialist knowledge and role of the participants.

Chapter 5 presents the results for Study 1.

Chapter 6 outlines the methodology for Study 2 which investigated the content and process of clinical decision making during as assessment task.

Chapter 7 presents the results for Study 2.

Chapter 8 discusses the findings from both studies and concludes with recommendations for future research

Chapter 2

Background to the Study and Literature Review of Assessment, Clinical Decision Making and Expertise within EAT and Methodologies to Investigate Clinical Decision Making

2.1 Introduction

This chapter presents a background to and critical appraisal of the key considerations in relation to clinical decision making (CDM) and assessment and provision of electronic assistive technology (EAT). Specifically the literature reviewed relates to:

i. the assessment frameworks within EAT;
ii. theories and models of clinical decision making including the CDM of the three professions studied for EAT;
iii. novice and expert decision making in EAT;
iv. methodologies employed to investigate the content and process of clinical decision making within healthcare.

2.2 Literature Review of Assessment Frameworks within AT

There are a limited number of published assessment models and frameworks available within electronic assistive technology to provide the practitioner with guidance. The majority of the AT frameworks that have been developed, are in relation to the outcome of provision, either from the user's perspective such as the Quebec User Evaluation of Satisfaction with Assistive Technology (QUEST) (Demers et al., 2002) or performance of the technology, such as the Psychosocial Impact of Assistive Devices Scale (PIADS) (Jutai and Day, 2002a). Bernd et al. (2009) recently undertook a review of assessment models and instruments for AT used in rehabilitation practice reported within the literature from 2003 to 2007. Three specific AT models were reported, two of which provide detailed information and tools to assist during assessment in order to prescribe appropriate technology; Matching Person and Technology (MPT) (Scherer, 1998) and The Framework for Modelling the Selection of Assistive Technology Device (Scherer et al., 2007). The third, the Human Activity Assistive Technology Model (HAAT) (Cook et al., 2008) provides a framework for assessment but unlike the previous two, does not provide specific tools. Although the literature review by Bernd et al. (2009) was limited, specifically with regard to the narrow timescale employed and the searching of only one database, the medically-orientated MEDLINE, where studies which reflect a social focus may have been excluded, no further models appear to have been published. The literature review was followed by a postal survey of assistive technology practice within 60 neurological rehabilitation settings across six European countries (the UK was not included). Taking into consideration the limitations of the findings and small variability in the sample of which 89% were OTs, they are nevertheless interesting. The most commonly prescribed AT was for personal care and protection, home adaptations, housekeeping, furnishings and personal mobility. No reference was made to electronic assistive technology. One third of the respondents (*n*=10) reported that they used a theoretical framework for the selection of AT, but the majority of these were non-AT specific. The HAAT model (Cook et al., 2008) was the only specific AT framework reported. Although the MPT is the most published model and has been validated for use with adults with disabilities with good reliability (Scherer and Glueckauf, 2005, Scherer et al., 2005, Scherer and Craddock, 2002) it was not reported at all as being used.

In an editorial in 2001, Scherer commented upon the need to move away from the medical model of assessment within AT in which more focus was placed upon the technology than the service user's preferences and which, she argued, contributed to the high rate of abandonment of technology. Instead, services should incorporate the social model of disability and afford more emphasis to the user and reflect a partnership approach to assessment and selection of equipment. In the same year the ICF was endorsed and became the international standard to describe and measure health and disability.

The MPT, which was derived from a grounded theory study and initially published in 1998, has similar theoretical underpinnings to the ICF model in terms of the importance placed upon the interrelationship between person and their context. The MPT claims that the characteristics of the person, their environment and the technology should be viewed as interacting during assessment and selection for EAT. The focus is on enabling the user to drive the process in collaboration with the AT practitioner and this is facilitated by the completion of a range of assessments (separately by the practitioner and the user) in order to ascertain the user's perspective and abilities, the environments in which they will use the technology and the features and functions required of the technology. Once the MPT is complete it is claimed that the information is used to assist with decision making but should not replace professional judgement.

There are seven clearly delineated steps to the MPT, which are:

1. *Initial Assessment for the MPT Process:* identification of strengths and needs, goals, purpose of proposed technology and central interventions to support goals.
2. *History of Support Use:* identification of satisfaction with previous support.
3. *Specific Technology Matching:* completion of the relevant form or forms:
    a) *Survey of Technology Use* in order to identify the mainstream technologies with which the user feels comfortable and confident;
    b) *Assistive Technology Device Predisposition Assessment* to assist the user to select an assistive technology;
    c) *Cognitive Support Technology Device Predisposition Assessment* to consider support to specific cognitive functions;
    d) *Educational Technology Predisposition Assessment* to enable students to achieve their educational goals;
    e) *Workplace Technology Predisposition Assessment* for employers and those introducing new technologies into the workplace and providing training in their use;
    f) *Health Care Technology Predisposition Assessment* related to devices to support health and care.

4. The practitioner discusses with the user any potential difficulties with their acceptance of AT derived from the assessments.
5. The practitioner and the user discuss intervention strategies and create an action plan.
6. The strategies and action plan are put in writing.
7. A follow-up assessment is planned to check the technology, current priorities and achievement of goals.

The second model, the Framework for Modelling the Selection of Assistive Technology Device (ATD) (Scherer et al., 2007) proposes that the selection of AT occurs within the context of and is influenced by environmental and personal factors based upon a review of the literature and the ICF model. It is proposed that these factors influence both the provider and the service user and impact the decision making and selection of appropriate technology. The environmental factors identified which may affect the service provision include cultural and financial priorities, legislation and policy and the attitudes of the other significant people in the organisation and within the user's social context. The personal factors include financial resources, the user's family and wider social circle, knowledge and information, expectations and personal preferences and priorities. While the authors recognise that this is a preliminary framework and acknowledge that it is likely to be modified over time, it is a valuable addition to the limited literature on assessment within AT. Further research is required in order to investigate if additional factors influence decision making and if such factors differ dependent upon the type of assistive technology being prescribed.

The third model, the Human Activity Assistive Technology Model (HAAT) (Cook and Hussey, 1995) was derived from the Human-Context-Activity Model (Bailey, 1989), which shows the interaction of the person undertaking an activity within a specified context and takes into consideration the impact of physical environmental constraints. However, within this model the use of assistive technology is not considered to enhance the person's performance (Haynes et al., 2009). Cook and Hussey (1995) modified the model to include AT and expanded the context to include environmental factors relating to social and cultural influences (Figure 2.1). Within this model therefore these three factors are interdependent on each other and occur within a specific context. Human performance is therefore measured by the person using assistive technology to undertake a task in a specific setting, which will be influenced by environmental contextual factors. In relation to EAT, this may be a service user with limited physical mobility (Human) operating an environmental control (AT) to open an external door (Activity) to enable friends to come for coffee (Context).

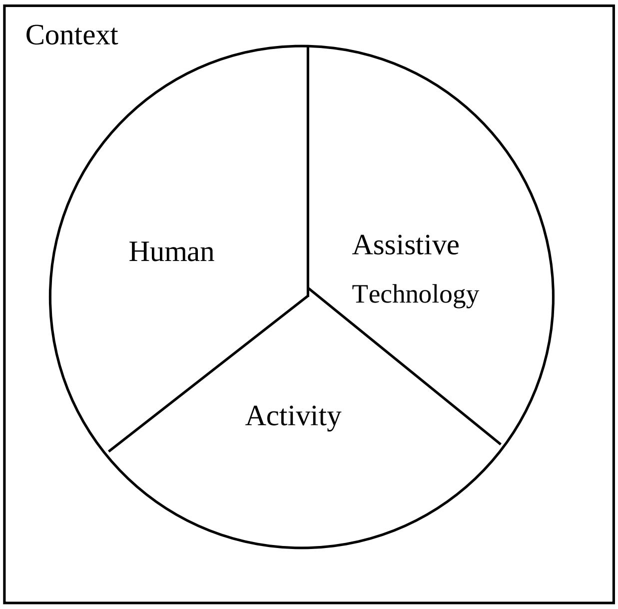

Figure 2.1: Human Activity Assistive Technology Model, Cook et al., (1995)

Although the model provides a useful framework for assessment it is not a validated measure. It encourages the practitioner to think from a person-centred perspective but, unlike the MPT and ATD it does not offer specific tools in order to undertake a comprehensive assessment.

Each of the above models offers guidance within the assessment process for AT. The models are similar in their common theoretical underpinnings and their focus upon the interrelationship between the person and their environment. Corradi et al. (2012) stated that the MPT is the first theoretical model to focus upon the participation of the user in selecting the appropriate technology and proposes that, given the complexity of matching the person to the technology, a comprehensive assessment is required prior to selection of the device. The MPT model (Scherer, 1998) provides the most detailed guidance for assessment whereas the HAAT model (Cook and Hussey, 1995) provides an overarching structure and the Framework for Modelling the Selection of Assistive Technology Devices (Scherer et al., 2007) focuses on the wider issues and external influencing factors which may impact selection and provision of AT. Future research which investigates the clinical outcomes of routine clinical use of these models would be helpful to AT practitioners.

The MPT and ADT models require the practitioner to become conversant with a new assessment tool, which for some may not be possible due to financial and time constraints. With these constraints in mind, a recent European study sought to apply the ICF framework as a tool for AT selection (Steel et al., 2011). As noted earlier, there is evident compatibility between the theoretical components of the ICF and the MPT and several authors have also discussed its use in assessing outcomes within AT (Fuhrer et al., 2003, Jutai et al., 2005). The new computer-based tool, named the Assistive Technology Evaluation and Selection (ATES) provides a structured pathway for the novice and generalist practitioner to sequentially organise information when prompted, which may be acquired from a range of sources, including an MPT assessment form. It is comprised of three steps which focus on different components of the assessment process (Figure 2.2).

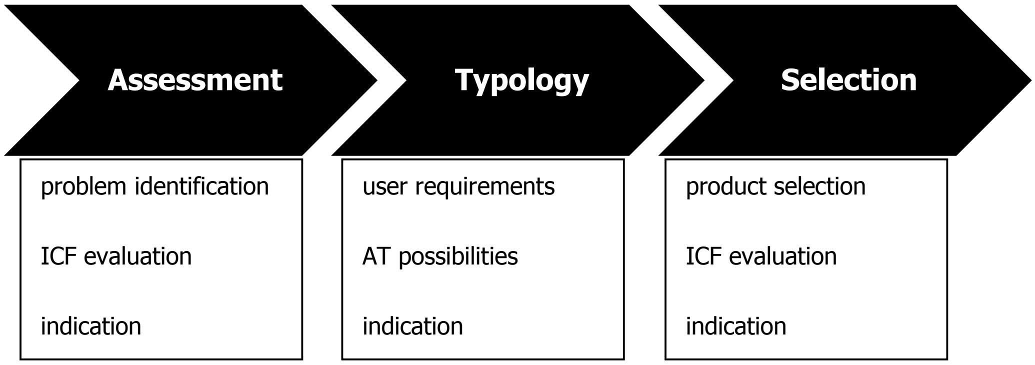

Figure 2.2: Summary of the Three Steps of the Assistive Technology Evaluation and Selection (ATES) Tool

Based upon the inputted information, step one prompts are supplied to encourage the practitioner to analyse the user's capabilities, limitations, facilitators and barriers under each component of the ICF model, for example, activities and participation. Step two investigates the user requirements and goals and seeks to reduce product bias by focussing on the user's needs and AT properties. In step three the technology is selected and the plan for implementation agreed. A summary report is available at the end of the assessment.

It is likely that this tool will be used by novice practitioners and the use of the prompts may further their clinical reasoning. However, by organising the input of information in a sequential framework it appears to assume that decision making occurs in an ordered linear fashion, which is contrary to the majority of clinical decision making literature (Fleming, 1991, Roberts, 1996a, Grobe et al., 1991) and the findings of this study.

The philosophy and components of the ATES tool concur with the overarching process model of assessment proposed by Federici et al. (2012), the Assistive Technology Assessment (ATA) process model, which is consistent with the ICF and which emphasises the individual's well-being and matching the person to the technology.

2.3 Literature Review of Clinical Decision Making and Theories, Models and Frameworks

Within the decision making literature the terms clinical decision making, clinical reasoning, diagnostic decision making and clinical judgment are often used interchangeably to refer to the process of decision making. Pelaccia et al. (2011) defined clinical reasoning as an "idiosyncratic, multifaceted and highly complex skill, characterized by different processes that mobilize *(sic)* specific knowledge held in long-term memory" and this is the view commonly utilised within the clinical literature. A similar but more encompassing perspective of clinical reasoning is presented by Higgs and Jones (2008) who regard it as the "sum of the thinking and decision making processes.. as contextualised interactive phenomenon rather than a specific process". This latter view is more frequently found within the OT literature than medicine or nursing and will be considered later in the chapter. In relation to judgment and decision making within the clinical context, a distinction was proposed by Dowie (1993) whereby he defined judgment as "an assessment between alternatives" and decisions as "choosing between alternatives". In clinical terms, a judgment may therefore be associated with the process of assessment which will culminate in making a decision.

Research into the process and outcome of clinical decision making has been ongoing since the 1950s. Over the last six decades a number of decision making theories have emerged which have been applied within medical and healthcare studies. These theories can be broadly classified into three approaches, each taking a different perspective of decision making and originating from different disciplinary backgrounds including mathematics and economics, psychology and behavioural sciences and operations and management research. The following taxonomy was reported by Bell et al. (1988):

i. normative, which considers *how decisions should be made in an ideal world* where decisions are based on logical and known conclusions supported by clear or probable evidence.

ii. descriptive, which considers *how decisions are made within a real world context* and no limitations are placed upon the exclusive use of rationality or logic.
iii. prescriptive, which considers *how to improve the quality of the decision made.*

Each approach is reviewed within this section and incorporates a review of clinical decision making research primarily within occupational therapy as there are limited decision making studies in biomedical engineering and speech and language therapy. Models and frameworks of CDM developed within medicine and nursing are discussed in relation to their utility within the field of EAT in Chapter 8, Section 8.2.

2.3.1 The Normative Approach

The underlying premise of normative theories is that decisions should be undertaken based upon a rational approach whereby the facts and values of all possible choices are evaluated prior to making a decision. They are often based on statistical modelling and probability theory and seek to evaluate how to make good decisions which have successful outcomes. Many studies within this approach utilise Bayes' Theorem, a statistical method which combines prior beliefs (probabilities) and preferences (utilities) to make a decision. However, the definition of such rationality is likely to differ between people dependent upon their worldview and as Thompson and Dowding (2009) reflect, an individual's goals are a function of their beliefs, preferences and desires. A purely rational approach therefore may be unrealistic and very limiting.

An influential figure within this paradigm was Meehl (1954) a psychologist who reported that clinical predictions were more accurate when made using statistics than clinical knowledge. In order to make a rational decision March (1994) suggested that questions regarding possible alternatives, the expectations, future consequences and personal preference of each alternative were taken into account. When undertaking such deliberations it is unlikely that an individual is able to consider all possible alternatives and their implications due to what

Newell and Simon (1972) termed "bounded rationality". They proposed that an individual's ability to think rationally was limited as the amount of information held within the short term memory and available for use was relatively little, relative to that contained within the long term memory. Whilst this concept was based on research in the late 1960s and early 1970s it is still accepted as current theory. Within assessment for EAT therefore, a bounded rationality view of CDM would accept that the clinician would be unlikely to be able to recall the complete evidence base for assessment and if they did so, are unlikely to have the computational ability and time required for processing within the assessment timeframe. What is likely to be recalled may be incomplete and decisions based upon such partial information may not demonstrate the best or most effective outcome. As the normative theory seeks to ensure optimal decision making and a key element is the evaluation and explication of risk. The expected utility theory (EU) and the subjective expected utility theory (SEU) provide a statistical method which can be used to assist with decision making by quantifying risks and benefits in order to maximise benefit and minimise risk.

An early application of the normative theory was employed within clinical decision making by Raïffa (1968) using decision analysis. Decision analysis has its theoretical foundation within EU and provides a method for deconstructing problems into their individual elements before reconstructing and synthesising them into possible decision options presented as decision trees (Dowie and Elstein, 1988).This approach is often adopted where linear judgements need to be made and where an optimal decision, based on the evidence can be deduced. Although decision analysis has been utilised within medicine and nursing (Thomson et al., 2006, Elkin et al., 2006, Offredy, 1998, Corcoran, 1986, Mutnick and Szymusiak-Mutnick, 1996, Owens et al., 1987, Kim, 2005, Doubilet and McNeil, 1982) there do not appear to be any clinical studies in the professions under investigation which have utilised decision analysis.

2.3.2 The Descriptive Approach

Unlike normative theory, descriptive theories of decision making (DM) seek to describe and understand how decision making occurs in practice and recognises the likelihood of less than optimal decision making. Each theory is reviewed alongside a critique of research within BE, OT and SLT if available. Orasanu and Connolly (1993) state that decision making is influenced by a wide variety of factors and they outline seven characteristics of decision making in dynamic settings:

i. the problems are ill structured and may be made more ambiguous by incomplete information and multiple interacting goals;
ii. the decision making environment is dynamic and may change throughout the decision making process;
iii. goals may shift, be ill-defined or competing;
iv. the decision making process occurs as a series of action – feedback loops whereby the effect of actions may generate further information which the clinician needs to take into consideration;
v. decisions take place within the context of time pressure, personal stress and tiredness, any of which may influence the complexity of the reasoning strategies employed;
vi. there may be multiple individuals undertaking different roles and who are actively involved in the decision process;
vii. organisational values and goals may influence decision making.

2.3.2.1 *Information Processing Theory*

The dominant descriptive theory within the clinical decision making literature is the information processing theory (IPT) in which Newell and Simon (1972) state that the process of decision making is analogous to computing and information systems. They proposed that reasoning consists of a relationship between an information-processing system (the person) and the task environment (the problem). The task environment, the problem, is represented internally as a problem space and the structure of the problem space determines the information processing activities to be used in the search for a solution.

Information is stored within the memory system which is comprised of at least three components which differ in their storage capacity and accessing characteristics and include the working memory, short and long-term memory. The short-term memory has a limited capacity for information which can be retained for an intermediate length of time which is a key aspect within the concept of bounded rationality mentioned previously. Miller (1956) found that the short-term memory could only hold seven plus or minus two symbols or familiar patterns (chunks) at any one time after which the information is lost or stored in the long-term memory (a finding which is still accepted currently). However, they showed that the capacity of the short-term memory could be greatly enhanced by chunking information into familiar patterns and those with significant domain-specific knowledge could more easily chunk and thus make more efficient use of their short-term memory. They also showed that the long-term memory has a very large capacity and information can be retained for indefinite periods of time although retrieval of information is slower than from the short-term memory.

Using the IPT as the theoretical framework Elstein et al. (1978) investigated the diagnostic decision making of 24 purposively selected experienced physicians. These series of studies revealed that the physicians employed a four-stage hypothetico-deductive process when undertaking diagnostic medical decision making. The initial stage, *cue acquisition* was the process of selectively collecting data over a period of time in order to generate a number of early hypotheses regarding possible diagnosis. In IPT terms, the development of these hypotheses is placing workable boundaries on the problem space in order to enable the clinician to ask specific and directed questions. Within the *hypothesis generation* stage between four and seven hypotheses were considered. The upper limit of seven is not a reflection of the extent of the clinician's knowledge but rather the largest number that can be evaluated simultaneously taking into account bounded rationality and memory capacity (Simon, 1974). In order to maximise functionality of the problem space the clinician can replace a hypothesis with reformulation of the problem. This *cue interpretation* stage enabled the clinician to consider if the cues supported, refuted or did not contribute towards the preliminary hypotheses. In the final stage *hypothesis evaluation* the clinician selected the hypothesis supported by the strongest evidence.

This information-processing model of decision making provided a framework for diagnostic medical decision making and became the basis for subsequent models of decision making within healthcare. Generated when the medical model of disability was dominant within healthcare, it is uni-disciplinary and focuses upon the medical symptoms exhibited by the individual. The impact of external factors such as psychological and social status are not explicitly taken into consideration during the diagnostic decision making process.

Subsequent information-processing models within nursing applied and extended the model in a number of ways. Carnevali (1984) demonstrated a series of components which extended the scope of information gathering prior to the clinical encounter, taking into consideration the implications of the individual's demographic data, for example their home address and next of kin, which informed their decision making.

Similarly, the seven-stage framework proposed by Carroll and Johnson (1990) emphasised the importance of pre-clinical encounter data, action and feedback. Their pre-decisional activities are not as clearly delineated as Carnevali's (1984) and they emphasise that the recognition stage in their framework includes many common everyday activities, unrelated to their profession, such as reading the newspaper and talking with friends which are important in enabling an individual to prepare for future decision making. They suggest that once it has been recognised that a decision is required, the next step is to explore and classify the situation. While it is helpful for clinicians to have a metacognitive awareness of factors which influence their decision making, such pre-decisional activities are more appropriate for situations where the decision making task or clinical problem is unspecified or ill-structured and identification of the problem is required first. Two studies (Bryans and McIntosh, 1996, Kennedy, 2002) have explored the applicability of the Carroll and Johnston (1990) model within community nursing, an area which has similarities to EAT and complex disabilities. Bryans et al., (1996) concluded that the Carroll & Johnson (1990) model was an appropriate conceptual framework for decision making within community nursing as it facilitated examination of the complete process of assessment.

A further framework which includes a number of aspects similar to EAT and complex disability is The International Confederation of Midwives—Midwifery Framework (Jefford et al., 2011). The medical and social models of health provide the theoretical underpinnings of midwifery practice (van Teijlingen, 2005) and emphasis is placed upon the role of the woman in the decision-making process. Decision making is a partnership between the woman and the midwife with the balance of power resting with the woman. Contextual factors and the emotional responses of both the woman and the midwife are taken into account within the decision making process. Jefford et al., (2011) concluded that while the hypothetico-deductive model was useful, it was incomplete and reductionist in its dependency upon reason.

In a 2011 study within psychiatric medicine, (Bhugra et al.) a biopsychosocial approach (Engel, 1977) was shown to have been adopted during the assessment of patients in which thirty-one psychiatrists were interviewed regarding factors which influenced their decision making and their process of decision making. This differs from the medical model adopted by Elstein et al. (1978) and such an approach is commonly adopted within the field of disability. Disability, an umbrella term for bodily impairments which limit the individual's activities and participation in society (International Classification of Functioning, Disability and Health, 2001) is a complex phenomenon which requires removal of environmental and social barriers in order to empower the individual (World Health Organisation, 2012). This psychiatric study appears to closely correspond to the biopsychosocial model of health adopted within assessment for EAT .

There is limited research investigating the use of the hypothetico- deductive model (HDM) within the three professions and the only studies reported are within occupational therapy where the HDM is also encompassed within the OT concept of "procedural reasoning" which will be discussed later in the chapter. In the early 1990s a key ethnographic study within occupational therapy known as the Clinical Reasoning Study investigated the clinical reasoning of 14 OTs working in large teaching hospitals. Based on this study Fleming (1991) reported a number of conclusions which were influential in developing further research within the profession:

i. there are few similarities between reasoning in occupational therapy and medicine, based upon the use of statistical modelling;
ii. whilst OTs utilised the four stages of the HDM their use of it was related more to treatment options than diagnosis;
iii. the HDM was not employed in a linear manner;
iv. the clinical reasoning did not result in a defined decision point, rather, there were a number of smaller decisions and temporary hypotheses;
v. pattern recognition was a common occurrence in experienced OTs.

Three other studies, also carried out in the 1990s, demonstrate the application of the model within OT, but limitations exist with the earliest study. Although Rogers and Holm (1991) successfully applied the model to an assessment process for a single case as carried out by an experienced OT; no detail is provided regarding the method of data collection. The study may have employed observation or retrospective interviewing or both but as this is not clear it is difficult to establish the validity of the results. A well-constructed single case study which employed videoed observation and interview was reported in detail by Fleming (1994) and in which the participant utilised the four stages of the HDM. The third study (Roberts, 1996b) investigated the content and process of 38 OTs who had at least 2 years' experience by employing a postal survey and using typical referral letters. They reported that the OTs employed components of hypothetico-deductive reasoning, in a non-linear pattern, in addition to pattern recognition. Additional processes were also reported which were related to the management of the case and therefore beyond the scope of the hypothetico-deductive model. No later studies appear to have been undertaken so current practice is unknown.

2.3.2.2 *Heuristics and Biases Theory*

Tversky and Kahneman (1974) observed that the rational approach was not consistent with real-life decision making and people employed a range of intuitive cognitive shortcuts which were time-saving and generally effective, in order to reduce the complexity of a task. However, alongside the advantages of heuristics, it was clear they could also lead to systematic and predictable errors or biases. Using three frequently occurring probabilistic heuristics; availability, representativeness (also known as pattern recognition) and anchoring and adjustment, Cohen (1993) and Elstein (1999) reported on commonly occurring errors. Over the last decade Croskerry et al., (Croskerry, 2009a, Croskerry and Norman, 2008, Croskerry and Nimmo, 2011) has reported extensively on the use of heuristics and presence of cognitive errors within emergency medicine. Although his focus is emergency medicine, his work may have application within the wider field of healthcare and decision making and may be relevant for the three professions under investigation. While no research appears to have been carried out investigating the use of heuristics within the three professions, based upon early research with undergraduates (Kahneman et al., 1982, Kahneman and Tversky, 1973) it is arguable that they are just as likely to be employed by participants from the three professions. It does not appear to be a profession-specific trait but rather a feature of human decision making.

2.3.2.3 *Cognitive Continuum Theory*

The Cognitive Continuum Theory (CCT), developed by Hammond (1996) states that intuitive judgement and scientific experiments are opposing ends of a continuum of modes of practice. The clinician selects the mode of practice depending on the characteristics of the task and the time available for completion (Figure 2.3). The decision maker is likely to make a decision based on intuition if the task is, or is perceived to be, relatively unstructured whereas a more analytical approach, similar to that of a scientific experiment, will be employed with well-structured tasks. Therefore, the key factor in determining which approach is undertaken by the clinician is determined by the characteristics of the task and not their degree of expertise. The most appropriate cognitive mode to use for each task depends on three factors:

i. The structure of the task;
ii. The number of information cues;
iii. The time available to make the judgement or decisions.

Whilst there do not appear to be any studies which have used CCT within OT, Harries and Harries (2001) considered that, as it was a continuum and not dichotomous, it could be valuable in helping to understand the difficulties in accessing the full range of reasoning processes.

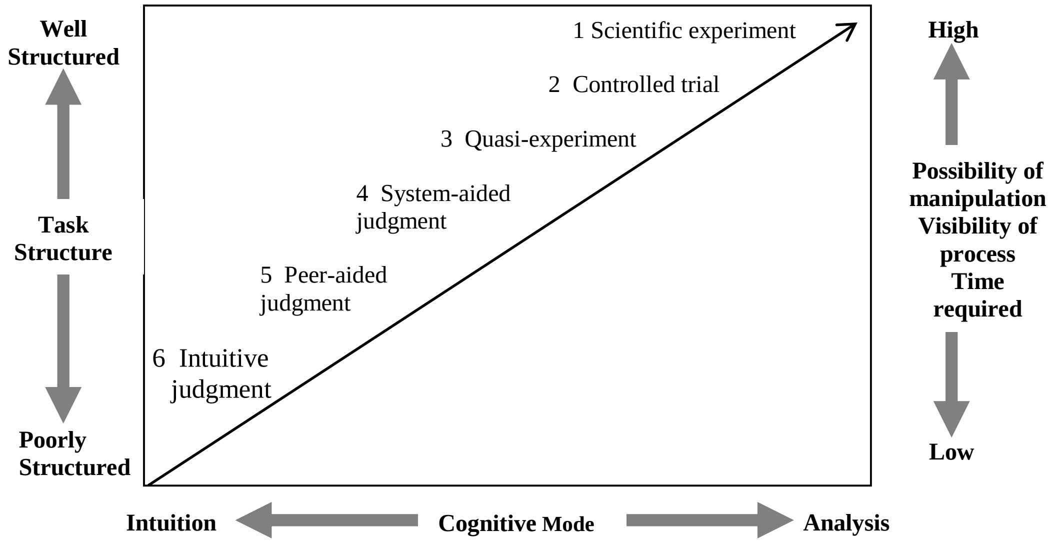

Figure 2.3: The Cognitive Continuum Theory Model

Although the cognitive continuum theory looks similar to the theories of dual-processing they are distinctly different (Evans, 2008, Osman, 2004). Within dual-processing an individual may switch from System 1 to System 2 within the same task whereas with the Cognitive Continuum Theory such switching does not occur and the same mode, whether at the intuition or analysis end of the continuum, is employed throughout the task.

2.3.2.4 *Dual-Process Theories*

Dual-process theories propose that two dichotomous yet interrelated modes of processing are available for decision making, which have been termed System 1 and System 2 (Kahneman and Frederick, 2002, Stanovich, 1999) and are cognitively related. The features attributed to System 1 processes are unconscious, rapid, automatic and high-capacity whereas System 2 processes are conscious, slow and deliberate, reflective, capable of solving abstract, difficult and novel problems (Evans, 2008, Evans, 2012). The ability to employ a checking mechanism has been highlighted as a key strength of the dual-approach to decision making (Pelaccia et al., 2011, De Neys and Glumicic, 2008). Although the concept of differing systems is not recent, the interrelationship between them has become the focus of research since the mid-1970s (Wason and Evans, 1975). Within cognitive psychology, dual-process theorists hold opposing views regarding the dominance of either system in reasoning and decision making. Kahneman and Frederick (2005) theorises that a heuristic approach takes precedence whereas Epstein (1994) and Sloman (1996) state that both routes are activated simultaneously and that individuals always take into account analytic considerations and are aware if they conflict with their intuitive beliefs. These opposing views were investigated in De Neys and Glumicic's (2008) well-constructed study in which 98 psychology students solved 18 problems, the results of which show a) the heuristic approach was dominant; b) if a conflict existed between heuristic beliefs and the information, further analysis of the information was undertaken. The use of the intuitive approach within clinical decision making has been seen as a positive addition to the rational approach (Greenhalgh, 2002, Woolley and Kostopoulou, 2013, Pearson, 2013, Benner et al., 2009) although caution has been recommended against overconfidence, which may lead to errors (Croskerry, 2002, Croskerry and Norman, 2008). Evans (2012) cautioned against the assumption that the correctness of the decision or response indicated which system was responsible, as it has been commonly assumed that the intuitive processes of System 1 are associated with cognitive biases and System 2 with correct responses. The theory has been applied within medicine and Croskerry (2009) proposed a schematic model in order to develop a universal approach towards diagnostic decision making. He cautions against attempting to artificially fit all reasoning into either system which is interesting as current thinking suggests that a tri-partite model which integrates dual-processing and meta-cognition may be in operation Marcum (2012). There does not appear to be any research as yet within BE or the therapeutic professions which has employed dual-process theories and it remains future research.

2.3.3 *The Prescriptive Approach*

The prescriptive framework originated with the work of Bell et al. (1988) who were concerned that there appeared to be a dichotomy between the normative and descriptive approaches and they proposed a need for theories to improve the quality of decision making in practice. The outcome of this approach lead to the development of decision trees for use within clinical practice and computerised decision packages which are designed to aid decision making (Thomson et al., 2006). Within the professions under investigation, the SLT profession developed evidence-based clinical guidelines (Taylor-Goh, 2005) in order to assist the practitioner with clinical reasoning and decision making.

2.3.3.1 *Social Judgement Theory*

The social judgement theory (SJT) is a theoretical approach which focuses on the judgements made as opposed to the decision. The theory combines elements of the descriptive and prescriptive approaches to decision making in that the central premise is an evaluation of how information is combined and weighted in order to assess the accuracy of the decision. It was developed from the ideas of Egon Brunswick who was interested in examining an individual's perception and judgement whilst taking into account the decision environment in order to demonstrate ecological validity. He developed a “lens model” to represent the relationship between the individual and their environment and by using correlation statistics he was able to identify the information used to make decisions (Doherty and Kurz, 1996). Within OT SJT was employed by Harries and Gilhooly (2011) in order to investigate the referral prioritisation policies of 40 OTs working in community mental health. Analysis of the weight afforded to each component past of the policy indicated that there was a wide variability in the application of policies. It was also used by Rassafiani et al. (2008) to explore factors which influenced 18 experienced OTs decision making management of upper limb hypertonicity. While this method enables access to the participants tacit knowledge it is cognitively demanding.

2.4 Theories of Expertise in Relation to Biomedical Engineering, Occupational Therapy and Speech and Language Therapy

Within the field of clinical decision making interest in what the qualitative differences are between novice and expert practitioners is seen within medicine and nursing.

Dreyfus and Dreyfus (1986) devised a model of skill development which incorporates five components, which when used in combination inform intuitive decision-making. These components include pattern recognition, similarity recognition, commonsense understanding, deliberate rationality and sense of salience. Benner (2004) investigated the application of this model within nursing in order to investigate the process of decision making of novice and expert practitioners. The model was situational and did not focus on the specific traits of the individual but rather was able to assist with assessing the development of expertise over time. One of the key traits of an expert is that they are able to organise their knowledge more efficiently than a novice (Elstein and Schwartz, 2000) and it appears that they have superior ability to problem-solving by demonstrating greater utility with the knowledge (Boshuizen and Schmidt, 1992). It may be that expertise is domain specific. Studies by Elstein and Schwartz, (2000) and Norman et al. (2007) showed that experts were able to identify patterns and connections in the information and thus reach a decision with greater speed. They suggest that experts ask fewer and more specific questions than novices who tend to use the HDM of decision making and generate a number of hypotheses before reaching a conclusion. Chi (2006) reported that the expert clinician is less dependent upon information gathering and can recognise patterns within the data and move rapidly towards a hypothesis.

One of the issues within the area of expertise is the question of defining an expert. A number of approaches have been adopted to assess the professional's level of expertise and include recording length of experience, their title and peer-recognition (Weiss et al., 2006).

There does not appear to be any research which has been carried out in relation to expertise within EAT for any of the three professions. Within OT interest in investigating the clinical reasoning of novice and experienced clinicians has been carried out but typically involves small numbers of participants (Gibson et al., 2000, Copley et al., 2010) and is therefore difficult to generalise the findings. A recent study (Rassafiani et al., 2009) employed social judgement theory in order to evaluate the decision making of OTs within cerebral palsy and the results indicated that this was an effective method in discerning differences between novices and experienced clinicians. Within physiotherapy, Rivett and Higgs (1995) reported that novice physiotherapists tended to ask more questions in the same order, regardless of relevance to the case. There does not appear to be research and expertise within SLT apart from the Hoben et al., (2007) study, which investigated the reasoning of undergraduate students and which is reported in the following section.

2.5 Clinical Decision Making in Biomedical Engineering, Occupational Therapy and Speech and Language Therapy

Little is known about the process and content of CDM in biomedical engineering and speech and language therapy. Two unrelated studies were identified within BE which although valuable provide limited insight into clinical decision making. An early descriptive paper reported the procedure and content of assessment in addition to the benefits of joint working between the BE and OT within EAT using a case study to illustrate (Gordon and Kozole, 1984). The second paper provided a summary of the development of a decision making model for use in equipment installations and purchases. (Ramirez, 1995). The model was a decision flow chart and is likely to have been derived based upon the principles of the normative theory of decision analysis.

Within SLT, the focus has been upon the outcome and not the process of CDM and a number of texts recommend the use of decision frameworks and decision trees in clinical practice (Dodd, 1995, Yoder and Kent, 1998, Manning, 2000, White, 2000). Duffy (1998) suggested that the processes of CDM have become unclear as a consequence of student training which views “diagnosis as a linear, test-orientated and mechanistic process.” In a journal editorial Campbell (1998) outlined four decision making approaches which he observed in the diagnostic decision making case studies presented in the journal by expert clinicians: decision making trees, diagnosis by exhaustion, hypothetico-deductive reasoning and pattern recognition. In an overview of CDM in the profession, McAllister and Rose (2000) suggested that the profession had adopted a content-orientated approach (Bridge and Twible, 1997) to clinical reasoning which assumed that knowledge and reasoning are interdependent.

Recent research into CDM has investigated the clinical reasoning skills of students (Hill et al., 2012, Hoben et al., 2007) and these two studies appear to reflect the current state of CDM research in SLT. Although both studies involve students they are distinct from one another and involved participants in Australia and the UK respectively. Hoben et al. (2007) carried out a videoed observation of the diagnostic decision making of 17 student dyads as they assessed a virtual patient. Nine of the dyads made an incorrect diagnosis as a result of incomplete domain knowledge in addition to difficulty interpreting results in relation to existing clinical data. Although not stated, the latter difficulty is similar to the cognitive bias associated with the anchoring and adjustment heuristic. They concluded that there may be common patterns of development from novice to expert as similar results were reported in nursing studies. The Hill et al., (2012) study investigated the reflective skills of 52 SLTs half-way through their four year degree as reflection is important in the development of professional skills. The majority of the students were able to comment on the process and content of the clinical encounter with a small number able to critically reflect. These studies demonstrate the emergence of interest in understanding CDM within SLT and the importance of facilitating development of professional skills.

In contrast to BE and SLT, the teaching of and research in clinical reasoning is well established within OT. Since the 1980s the profession has generated nomenclature for forms of reasoning which describe the process and content and which arguably, has led to a confusing complexity in terminology (Robertson and Griffiths, 2012). Chapparo and Ranka (2008) state that the descriptions and definitions utilised were “influenced by the diverse nature and goals of OT practice, the philosophy of the professions itself and the various epistemologies of individual researchers.” While such organic growth reflects a dynamic profession, there is the risk that the encompassing and descriptive terminology for different forms of reasoning could conceal the advantages for students and clinicians of critically reflecting on the actual process of reasoning and decision making. Robertson and Griffiths (2012) recommend that the profession would gain from thinking through the concept of problem solving more coherently and Boyt Schell et al. (2008) suggest similar reflection in relation to the information processing approach to decision making. Table 2.1 shows the different aspects of reasoning used in current clinical practice based on Boyt Schell and Schell (2008) definitions and which have been reported in the literature by Schell and Cervero (1993), Rogers and Masagatani (1982), Fleming (1991). Whilst useful as a tool for reporting the content of clinical interventions, it is difficult to extrapolate content from process.

Table 2.1 Different typologies of reasoning found within OT

Aspect of reasoning	Description
Scientific reasoning	Involves the use of applied logic and scientific methods such as the hypothetico-deductive model, pattern recognition
Diagnostic reasoning	Investigative reasoning and analysis of cause or nature of conditions. Can be one aspect of scientific reasoning
Procedural reasoning	Where the clinician considers and uses intervention routines for identified conditions
Narrative reasoning	Used to make sense of the individual's circumstances and create a collaborative story which is enacted through intervention
Pragmatic reasoning	Matching therapy possibilities with reality of service delivery
Ethical reasoning	Analysing ethical dilemmas and generating solutions
Interactive reasoning	Building a positive interpersonal relationship with the client
Conditional reasoning	A blending of all forms of reasoning in order to respond flexibly

Few studies have investigated the cognitive processes employed and those which have have identified the combined use of the hypothetico-deductive approach and pattern recognition during clinical reasoning (Rogers and Holm, 1991, Roberts, 1996b, Hagedorn, 1996, Fleming, 1991, Doyle et al., 2013). The methodologies employed within these studies were very varied and included survey, ethnography, retrospective thinking-aloud, survey and a single case study respectively. Doyle et al., (2013) reported that the OTs in their survey study employed Systems 1 and 2 in their assessment of stroke patients with upper limb sensory impairments. The authors report the number and percentage of respondents who answered each question but have not provided the number of respondents using either or both thinking systems. Additional limitations of the study include the low response rate (37%) to the postal survey and the wording of the closed questions which may have led the respondents to answer what they think they should do rather than what they do in practice. This means that the results need to be interpreted cautiously. Limited participant information was reported in the 1990s studies and sample sizes ranged from one to 38 OTs recruited from a variety of clinical fields and with variable experience. In a small, exploratory study, Hagedorn (1996) investigated the decision making processes utilised by six experienced OTs during initial assessment in physical rehabilitation settings using retrospective thinking-aloud. The findings showed that the process of reasoning was non-sequential and the hypothetico-deductive stages were employed in variable order. Roberts (1996) undertook a postal survey incorporating referral letter simulations with 38 experienced OTs to investigate the content and process of their reasoning. The key findings indicated that the hypothetico-deductive approach was employed and was extended to include an additional stage incorporating management. In the other hand, not all stages were employed by all participants.

The acquisition and development of clinical reasoning and decision making skills is an integral aspect of clinical practice in healthcare. Studies within medicine and nursing have explored how best to teach such skills within education and clinical practice (Croskerry, 2009a, Struyf et al., 2005) and it has been an on-going focus within OT for the past two decades (Carrier et al., 2012). Studies have identified the need to ensure that pre-registration students can apply theory to practice and an integral aspect of this process is deconstructing the key components within the decision making process (Gay et al., 2013, Charlin et al., 2012). The use of the three-item measure, the Cognitive Reflection Test (Frederick, 2005) may enable the students to develop an insight into their reasoning skills and become aware of their decision making processing. Toplak et al. (2011) assert that this straightforward test is a powerful measure of an individual’s tendency to adopt a cognitive-miserly approach to decision making whereby there is a tendency to respond to the questions with the first answer that comes to mind. In Frederick’s (2005) study of 3,428 participants, most of whom were university students across nine different universities, 33% of respondents scored 0/3 and only 17% got all three answers correct. However Toplak et al. (2011) assert that such a tool can assist in illustrating the use of the dual-process theory and support the development of students' metacognitive and reasoning skills.

2.6 Methods Used To Investigate Clinical Decision Making

Within healthcare the focus of clinical decision making research can be broadly categorised as investigating one or more of the following:

i. the process of clinical reasoning and decision making;
ii. the model of reasoning and decision making employed.
iii. the presence and application of domain-specific knowledge;
iv. the types and sources of information used;
v. the impact of influencing factors such as work setting, age of the patient;
vi. the appropriateness of the decision made;
vii. the differences between novice and expert practitioners.

The literature reports five qualitative methods that have been utilised to explore these aspects:

- thinking-aloud,
- observation,
- interview,
- survey
- focus group.

No one method was consistently employed to investigate specific aspects of CDM and each aspect was investigated using a range of methods. More than one method was frequently employed within each study in order to investigate the issue from more than one perspective and enhance internal validity by the use of methodological triangulation.

One of the challenges within decision making research is to utilise a method which is ecologically valid for the population under investigation and which minimises the opportunity for either researcher or participant bias. Early decision making research within medicine recognised the difficulty of a self-reflective approach to understanding one's own decision making (Nisbett and Wilson, 1977, Ericsson and Simon, 1980a) which in turn encouraged the development of alternative methods of enquiry. Within this section, each method will be reviewed in turn in the order of their reported frequency of use.

2.6.1 Verbal Protocol Analysis

Twenty-four studies have been identified which utilised verbal protocol analysis, commonly referred to as thinking aloud the earliest in 1987, the majority of which are within nursing (*n*=20), which is reflective of the clinical decision making literature in this field. The remaining studies include two studies undertaken with GPs, one with radiographers and another with OTs. Concurrent thinking-aloud is the most frequently employed method to investigate the content and process of clinical decision making and clinical reasoning within the health professions and was employed by 23 (95%) of the 24 studies. In order to generate the verbal protocol, it was most frequently utilised in combination with case scenarios and simulations created to reflect clinical practice (*n*=14), the format and delivery of which included:

i. written material (Grobe et al., 1991, Redden and Wotton, 2001, Funkesson et al., 2007, Ritter, 2003, Twycross and Powls, 2006, Denig, 2002);
ii. verbal handover report, video footage and clinical documentation (Lamond et al., 1996a, Tanner et al., 1987);
iii. verbally presented material (Jones, 1989, Cioffi and Markham, 1997) with photos (Offredy, 2002);
iv. video footage of acted scripts (Prime and Le Masurier, 2000);
v. PC-based interactive scenarios (White et al., 1992, Skaner et al., 2005)

A number of findings were derived from these studies which have had important clinical and methodological implications beyond the field of nursing:

i. the construction of a visual representation of nurses' clinical reasoning, which showed a non-linear pattern of reasoning (Grobe et al., 1991)

ii. that expert nurses use a combination of the information processing and hermeneutical models during diagnostic reasoning (Ritter, 2003);

iii. early application of the Problem Behaviour Graph within clinical decision making (Jones, 1989).

These findings show that a process-tracing approach, such as concurrent thinking-aloud does not restrict the participant to using a linear form of reasoning and that the method does not preclude the use of heuristics and pattern recognition.

TA has also been successfully employed in the investigation of a number of aspects of CDM. The process and content of decision making within medicine, nursing and radiography was investigated by Skaner et al. (2005), Denig (2002), Offredy (2002) and Prime and Le Masurier (2000). The participant's use of information was also investigated to learn more about the difference between novice and expert decision making (Grobe et al., 1991, Prime and Le Masurier, 2000, Redden and Wotton, 2001, Skaner et al., 2005, Hoffman et al., 2009). In each study the method was successful in answering the research question and the findings were applicable within clinical practice.

TA has been widely used within the CDM field to investigate the cognitive decision making processes undertaken during a decision making task (Tanner et al., 1987, Jones, 1989, Lamond et al., 1996b, Fowler, 1997, Twycross and Powls, 2006, Han et al., 2007, Aitken et al., 2011, Denig, 2002). Crutcher (1994) and Ericsson and Simon (1993) claim that it is the most effective method for investiagting aspects of decision making, which are otherwise difficult to obtain.

A well-designed comparative nursing study by Aitken et al., (2011) identified differences in the type of decisions detected when using thinking aloud and observation. Decisions which did not inevitably require an overt change in behaviour such as assessment and evaluation were more fully captured using TA than observation whereas management decisions were best captured by observation.

A limitation of the method is the difficulty in utilising it within natural settings as in most instances it would be inappropriate for the practitioner to think aloud in the presence of the patient. However, it has been sucessfully employed by nurses (*n*=4) during clinical practice with high dependency patients whereby the participants thought aloud as they carried out their clinical duties (Han et al., 2007, Fisher and Fonteyn, 1995, Hoffman et al., 2009, Aitken et al., 2011) followed by retrospective interviewing or retrospective thinking-aloud. In these studies the patients were heavily sedated and it is unlikely that they would have been aware of their surroundings.

Twycross and Powls (2006) noted that in their study the lack of difference in the information collected by experienced and less experienced nurses was surprising. They advocated that data collection should also occur in the natural setting to complement the TA data.

Observation has also been frequently utilised although to a lesser extent than TA and will be reported in the following section.

Although TA is a labour-intensive method, it produces rich detailed data and has been widely used in the CDM literature to investigate various aspects of CDM. Thinking aloud enables access to the persons' reasoning and decision making, which is not dependent upon a subjective explanation or interpretation of their thinking. Furthermore it can assist with the identification of contextual factors and aspects of habitual practice (Denig, 2002) of which the practitioner may be unaware (Nisbett and Wilson, 1977).

2.6.1.1 *The Use of Verbal Reports as Data*

Verbal protocol analysis, a process-tracing method developed in the late 1970s by Ericsson and Simon (1980) is designed to capture the cognitive processes when an individual is thinking aloud. Prior to the development of the Ericsson and Simon thinking-aloud method, the use of verbal report as data had been unpopular for many years as it was considered to be associated with the discredited practice of analytic introspection whereby subjects were asked to reflect and analyse their own thoughts (James, 1890). As it is methodologically imperative to understand the difference between introspection and thinking aloud, a detailed account is provided of the two methods. Justification for the selection of verbal protocol analysis as a method within this study is in the following chapter.

Introspection was reported in the psychological literature in the late 19th century by James who believed it to be an important tool for enquiring into an individual's thought processes and subjective experiences. Whilst advocating this methodology he was simultaneously aware of the inherent difficulty in ensuring that what was reported was reliable and stated "introspection is difficult and fallible" and queried if it was possible to be sure of the order of one's feelings. In 1913, Watson, stated "Psychology as the behaviorist (*sic*) views it is a purely objective, experimental branch of natural science which needs introspection as little as do the sciences of chemistry and physics". He considered that only observable behaviour that can be verified with objective measures should be acceptable for investigation and analysis of the "more complex forms of behavior (*sic*), such as imagination, judgment, reasoning and conception" should be delayed until better methods of investigation were developed. A decade later, Lashley (1923) proposed that introspection could be included within the behaviourism paradigm, although distinctly different from James' (1890) approach and that the purpose "must be the discovery of cues to physiological problems ..[it] may make the preliminary survey, but must be followed by the chain and transit of objective measurement". This approach dominated the psychological literature for the following three decades until the emergence of cognitive psychology in the 1950s, which was interested in methods which provided access to an individual's thought process. The use of verbal data remained a controversial method and Nisbett and Wilson (1977) contended that an individual may have little or no direct introspective access to higher order cognitive processes and that reliable analysis is impossible. They stated that an individual's ability to accurately report on their thinking is implicitly influenced by their *a priori* understanding of causal theories and therefore the resultant analysis of their thinking aloud is likely to be unconsciously influenced by such knowledge. In their seminal work, Ericsson and Simon (1980) confronted the issues related to the use of verbal data in psychological research in the preceding decades in which they addressed four main concerns:

i. the validity of verbal data within scientific research in relation to introspection and thinking aloud;
ii. the lack of methodological detail and rigour in verbal data collection and analysis;
iii. how the encoding of behaviour can be transformed into objective, hard data. Prior to the practice of recording the data and verbatim transcription, it was difficult to distinguish what was the raw verbal data from the researcher's encoding. The standard use of verbatim transcription and a theoretical model of information processing enabled researchers to be more explicit in their encoding;
iv. the theoretical underpinnings upon which the encoding is based and how the codes may be decided *a priori* based upon a particular theory or may be generated from the data in parallel with the development of a new theory or model.

They proposed that there should be a clear distinction between the practice of introspection and thinking aloud (Ericsson and Simon, 1993) and outlined a framework based upon Information Processing Theory (Newell and Simon, 1972).

2.6.1.2 *Theoretical Basis of the Thinking-Aloud Method*

During the development of the think-aloud technique, Ericsson and Simon were significantly influenced by Vygotsky's work (originally published in the 1930s, and re-published in 2012) on child language development and inner and social speech (Ericsson and Simon, 1998). As thoughts are verbalised, syntactically correct sentences are not formed nor is it a coherent discourse as the individual is not attempting to enable listeners to understand and "inner speech appears disconnected and incomplete" (p 249). Ericsson and Simon (1998) observed that when using the think-aloud method the resultant verbal protocol is likely to be a combination of complete and incomplete thoughts, which may be disorganised and out of sequence with no explicit link. Such verbalisations are consistent with Vygotsky's theory of inner speech and social speech (Vygotsky et al., 2012) The data generated during the thinking aloud process effectively represents information held within the short-term memory and is therefore representative of the cognitive processes in use. Building upon research in cognitive psychology and Duncker's work in thinking-aloud methodology (Simon, 1999) Ericsson and Simon asserted that the following assumptions formed the core of their thinking-aloud model (Ericsson and Simon, 1993):

i. thoughts which are verbalised can be described as states that correspond to the contents of the short-term memory, that is, to the information that is in the focus of attention;
ii. the information vocalised is a verbal encoding of the information in short-term memory;
iii. the verbalisation processes are initiated as a thought is taken account of;
iv. the verbalisation is a direct encoding of the attended to thought;
v. units of articulation, for example, intonation, stress and pauses, will correspond to integrated cognitive structures such as conceptual, syntactical and grammatical structures;
vi. pauses and hesitations will be good predictors of shifts in processing of conceptual structures.

They stated that the think-aloud verbalisations do not require interpretation by the participant (in contrast to introspection) and the resultant verbal protocols can be considered as objective data. They identified three levels of verbalisation and proposed that the act of asking an individual to think aloud their thoughts whilst problem-solving should not cause any reactivity or change the underlying cognitive processes involved. Each level is defined below:

- *Level I* verbalisation is when the individual thinks aloud concurrently whilst performing a cognitive task. It therefore provides direct verbalisation of the cognitive processes undertaken.

- *Level 2* is retrospective thinking-aloud where the individual is asked to report what they were thinking during a task previously undertaken. This can potentially lead to incomplete and inaccurate information as it is contingent upon accurate recall and may give rise to reinterpretation of thinking.

- *Level 3* verbalisation refers to instructions to verbalise specific information such as reasons and explanations. This form of verbalization requires the individual to interrupt their inherent temporal thinking sequence to provide the information requested.

These levels of verbalisation are distinctly different from each other and differ dependent upon the task requirements. They stated that if their methodological procedure for undertaking thinking aloud was observed for Level I there should be no change in the thoughts which are being heeded or the underlying cognitive processes, but it may prolong the completion time of the task.

The three levels of thinking aloud are illustrated in Figures 2.4, 2.5 and 2.6 and show the relationship between silent thinking and different modes of verbalisation.

Silent thinking

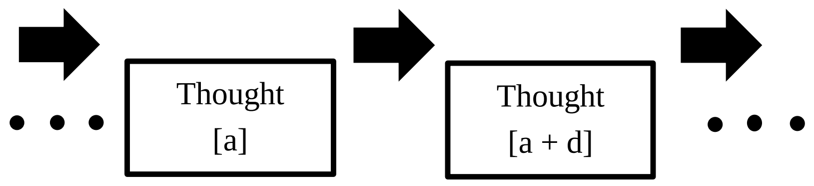

Figure 2.4: The Silent Thinking Diagram Shows the Spontaneous Sequencing of Thoughts Interspersed by Periods of Processing Activity, Represented by the Arrows.

Thinking aloud (Level 1)

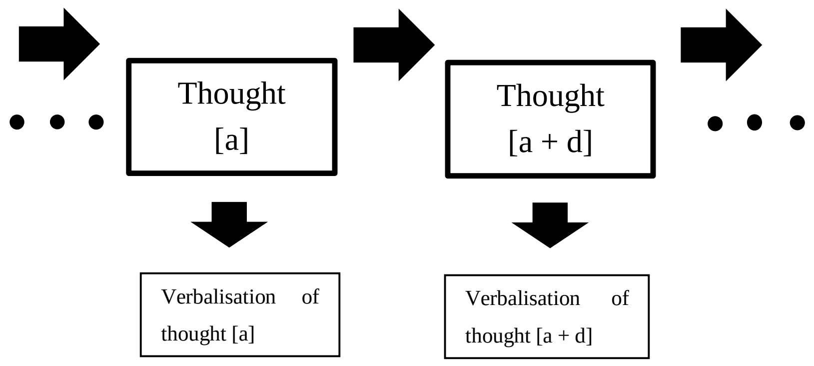

Figure 2.5: The Thinking Aloud Diagram Shows the Spontaneous Sequencing of Thoughts which are Verbalised without Interruption of the Sequence

Describing and explaining one’s thinking (Level 3)

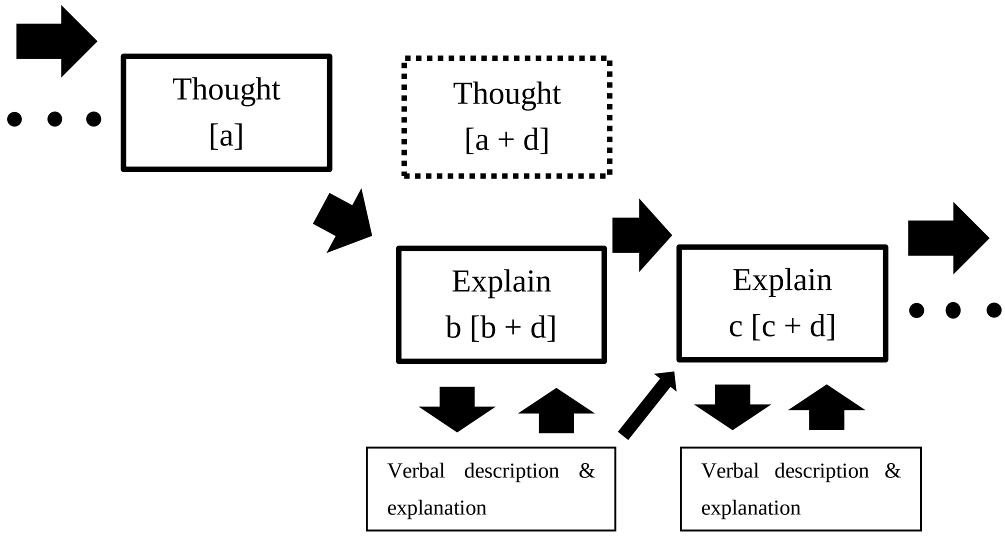

Figure 2.6: The Describing and Explaining Diagram Illustrates the Changes which occur to the Sequencing and Interruption of Thinking as the Individual Seeks to Describe and Explain their Thought Processes

The distinction between these levels is crucial when employing TA as it is Level 1 that is required. The following chapter will continue with the review of this method.

2.6.2 Observation

Twenty-one observational studies were sourced and this method has investigated the greatest number of aspects within the CDM literature. Triangulation of observations with other sources of data is common including TA, interview, survey and focus group. Gold (1958) suggests there are four distinct roles which the researcher can adopt, dependent upon the degree to which they are integrated into the situation, which are:

i. complete participant;
ii. participant-as-observer;
iii. observer-as-participant
iv. complete observer.

The majority of clinical decision making studies adopted the participant-as-observer approach in order to remain as uninvolved as possible within the clinical situation under investigation. However, a nursing study by Hagbaghery et al. (2004) reported that although they adopted the participant-as-observer method and were requested not to formally care for the patients, they provided occasional assistance to the observed nurse on request. Unfortunately, the impact this may have had on the validity of their findings was not reported. Additionally, an early CDM study in OT by Rogers and Masagatani (1982) described their approach as participant observation, as defined by Spradley (1980), yet the information reported outlines a participant-as-observer approach with no evidence of engagement with the participant. It may be that their use of the Spradley definition (1980) whereby participant observation refers to a general approach within fieldwork and not the specific degree of research involvement as defined by Gold (1958).

Several studies also video-recorded observation data collection sessions in order to provide a stimulus for discussion during a later interview (Wainwright and McGinnis, 2009, Wainwright et al., 2011, Alnervik and Svidén, 1996, Noll et al., 2001, Unsworth, 2005).

There does not appear to any studies in which the researcher adopted the role of complete participant, observer-as-participant or complete observer.

The advantage of non-participant observation is that it enables the researcher to investigate decision making within a natural setting and observe what actually occurs as opposed to what the participant reports. It enables comparison of the participant's report of the situation with the researcher's observation records which can lead to insights as Robson (2011) reports that there are frequent discrepancies between the two accounts. A disadvantage is the possibility that the Hawthorne effect and the Rosenthal phenomenon may influence behaviour of both the participant and the patient (Denzin and Lincoln, 2005). Additionally, recording the observation may affect the willingness of participants to take part and thereby result in a self-selected sample of participants who are comfortable with this methodology.

The combination of methods is reviewed below and is ordered based upon the frequency with which the design was employed.

i. **Observation and interview combinations**

This was the most frequently used combination which accounted for over 75% of the observational studies. It also investigated the greatest range of aspects.

a) *Observation and interview (n*=9)

This method was used to investigate the:

- impact of influencing factors (Hagbaghery et al., 2004, Bucknall, 2003, Smith et al., 2007);
- types and sources of information used (McCaughan et al., 2005, Copley et al., 2010);
- process of decision making (Smith et al., 2008, Rogers and Masagatani, 1982);
- model of clinical reasoning (dela Cruz, 1994)
- differences in experienced and novice OTs (Gibson et al., 2000).

These studies show that this is a time-intensive method which generally involves multiple observations and interviews over a period of time. The sample size differed substantially from single cases (Copley et al., 2010) to 38 participants (Hagbaghery et al., 2004) and involved nurses, OTs and physiotherapists. There are apparent advantages with this method, particularly for investigating the impact of influencing factors and context (Denzin and Lincoln, 2000) and types and sources of information employed as observations may occur in different settings and different times of the day. The researcher's observations can inform their interview guide and may provide a different perspective than the participant's. The interview may take place immediately or within several days of the observation which appears to depend upon the purpose of the interview. In Smith et al. (2008) and Rogers and Masagatani (1982) the post-observation interviews were carried out immediately after each episode of patient care in order to facilitate recall of their decision making processes. Using this method for investigating the differences in expert and novice CDM may be less appropriate and arguably valid as the presence of the researcher may change the behaviour of the novice clinician.

a) *Videoed observation and interview* (*n*=6)

The addition of video was implemented by videotaping the clinical interaction, with the consent of the participants. These studies also investigated the:

- impact of influencing factors (Wainwright and McGinnis, 2009);
- process of clinical reasoning (Alnervik and Svidén, 1996)
- decision making of experienced and novice practitioners (Wainwright et al., 2011, Mitchell and Unsworth, 2005, Noll et al., 2001, Unsworth, 2001).

The participants within these studies were OTs and physiotherapists and the sample size ranged from 1-13 participants. Arguably, the incorporation of video into therapeutic settings as opposed to nursing is more practicable and offers more control over what can be recorded. In addition to the issues raised in the previous section, the inclusion of video may have impacted the behaviour of the participant. However, none of the studies report on the impact of the video on behaviour which would appear to be an important limitation in accepting the validity of the findings.

ii. **Observation, retrospective thinking aloud and interview**

a) *Observation, retrospective thinking aloud and interview* (*n*=2)

This method was utilised to investigate the:

- differences in experienced and novice decision making (Doody and McAteer, 2002)
- model of decision making (Offredy, 1998)

The participants included 20 nurse practitioners and 20 physiotherapists. The methodological issues within this method are similar to those for observation and interview. The combination of retrospective TA and interview enabled the researcher to enquire into issues beyond the participant's recall of the session and provided a robust method..

iii. **Observation and focus group combinations**

a) *Observation and focus group* (*n*=1)

- process of decision making (Porter et al., 2007)

b) *Observation, focus group and interview* (*n*=1)

- process of decision making (Young, 2012)

These well-designed studies with sample sizes ranging from 24 to 49 participants, investigated multiple perspectives regarding the process of decision making within midwifery and Young (2011) sought to triangulate the data sources to increase the validity of the findings. The use of observation and focus groups enabled a wider perspective to be achieved and by using different participants in the focus groups (as in both studies) findings from the observational data could be confirmed, clarified and extended.

2.6.3 Interviews

Interview methodology has been employed within the clinical decision making literature for a variety of purposes. It is primarily used in combination with either observation as outlined above or in combination with written clinical material, for example, case scenarios (Lyneham, 1998; Offredy, Kendall, & Goodman, 2008; Sweeney & Doody, 2010) or a computer simulated patient (White, Nativio, Kobert, & Engberg, 1992). A review of the literature indicates that it has been employed in isolation to

i. investigate the domain-specific knowledge in OT, physiotherapy and nursing (Kuipers & Grice, 2000; Lamond et al., 1996a; Offredy et al., 2008; Sweeney & Doody, 2010),
ii. to identify the model of reasoning used within nursing (Lyneham, 1998; White et al., 1992),
iii. to examine the processes undertaken during discharge planning and use of information by physiotherapists and OTs (D. Jette, Grover, & Keck, 2003(McGinnis et al., 2009).
iv. Factors influencing GPs (Mears & Sweeney, 2000).

2.6.4 Survey

Survey has been employed to investigate:

i. the impact of contextual influencing factors within nursing was investigated by Hoffman (2004);

ii. the appropriateness of the decision made (Reich et al. (1998) involved occupational therapists in discharge planning. Jette et al., (2006) studied 394 physiotherapists and investigated the provision of intervention.

iii. the process of clinical reasoning and decision making. Using a modified questionnaire, Case et al. (2000) investigated the thought processes of 30 physiotherapists. The questionnaire contained a case scenario with two sections detailing subjective and objective information. The advantage of this design is that it generates information which can be analysed for content and organisation of thinking but the disadvantage is that it is unknown if the responses are a reflection of the participant's own thinking or if they have been influenced by discussion with colleagues.

iv. the model of reasoning employed was explored within occupational therapy by Mitchell and Unsworth (2004) and Roberts (1996) and in nursing by Lauri et al., in 1998 and 2001.

2.6.5 Focus Groups

Morgan (1996) suggested that the key feature of focus group methodology is their role in generating data and insights which arise specifically as a result of group interaction. Kuipers et al., (2006) successfully used focus groups with 11 OTs to investigate the factors that influence clinical decisions and Porter et al.

(2007) ran a focus group using case vignettes, subsequent to participant-as-observer observation of 24 midwives, in order to explore the rationale for their actions. Young (2012) in her investigation regarding how students and newly qualified midwives learn to make decisions, incorporated focus groups in addition to observation and interviews in order to understand the culture of the students.

2.7 Chapter Summary

This chapter has reported on the literature in relation to assessment within EAT, clinical decision making and expertise research within the professions under investigation. It has also reviewed the methodologies undertaken in CDM research within healthcare. The following chapter presents a justification for the methodological approach employed.

Chapter 3

Justification of the Research Approach

3.1 Introduction

This chapter explores the methodological approaches available to this study in order to examine the factors which inform the clinical decision making (CDM) of the professions under investigation. Two studies were carried out which employed the same population sample but different methods in order to study different aspects of CDM. Alternative methods considered for each study are discussed. The aims of the study were to:

i. explore the participants' perceptions of their specialist knowledge and role in the assessment of EAT (Study 1);

ii. investigate the similarities and differences in the content and process of CDM during assessment and prescription of EAT for adults with an acquired brain injury (Study 2);

The subsidiary aims were:

i. To examine whether there are differences in CDM:
   a. between disciplines;
   b. between specialist assistive technology centres and non-specialist centres;
   c. between experts and novices.

ii. To explore the different theoretical models of CDM in relation to EAT assessment.

3.2 Design

A mixed methods design was employed in order to comprehensively answer the aims of the study by integrating the findings from qualitative and quantitative methods and drawing inferences. The mixed methods design has been recognised as an approach situated within a third paradigm and rejects the traditional dualism of qualitative and quantitative designs. It combines the major characteristics of each design, induction from qualitative and deduction from quantitative approaches, resulting in a method that brings together the complementary strengths and dilutes the non-overlapping weaknesses (Brewer and Hunter, 1989). A key strength is that it allows the exploration of complex phenomena in a manner not possible using a single approach (Cherrybolmes, 1992). Integrating the qualitative and quantitative findings is a key concept in mixed methods research (Tashakkori & Creswell, 2007). Onwuegbuzie and Leech (2005) suggest that mixed methods can help bridge the schism between the two designs, which are often presented as polarised extremes. The mixed methods design is situated within the pragmatic method and system of philosophy, which advocates that research approaches should be mixed in ways that offer the best opportunity for answering the research question. A fundamental tenant of pragmatism is the view that the research question should determine design as opposed to a method or paradigm and that a false dichotomy exists between qualitative and quantitative approaches (Newman and Benz, 1998). In a methodological review of mixed method healthcare studies, Östlund et al. (2011) reported that it can "help to highlight the similarities and differences between particular aspects of a phenomenon"; an approach that was appropriate for this study. This complementation approach was used in this study where the primary method of analysis was qualitative in order to explore meaning while quantitative analysis was used to explore causal relationships and search for patterns (Denzin and Lincoln, 2005). Methodological triangulation was undertaken to increase the validity of the findings.

3.3 Review of Methods

3.3.1 Review of Methods to Answer the Research Questions

Methodologies reported in the literature which investigate CDM have been critically reviewed in Chapter 2, section 2.6. This current section will therefore summarise a justification for selection of interview for Study 1 and concurrent verbal protocol analysis for Study 2.

Studies which have employed observation have investigated the contemporaneous content of CDM (Gibson et al., 2000, Wainwright et al., 2011) but not the participant's tacit decision making process. To explore the process required additional interviewing and the use of retrospective thinking-aloud (Wainwright et al., 2011), focus group participation (Porter et al., 2007) and survey (Barris, 1987).

Within this study the use of **observation** would have permitted analysis of a typical EAT assessment in addition to providing insight into the working of the multidisciplinary team and user involvement. Information regarding the context and culture within which decision making occurs would also have been gained. However, within the qualitative paradigm, the situation being observed is intrinsically changed by the presence of the researcher and the presence of the researcher must be taken into consideration when interpreting the findings (Denzin and Lincoln, 2005). The aim of the current study was to access the participants' contemporaneous and unfiltered thinking during a CDM task in order to access the cognitive processes in addition to the content and therefore observation was rejected as:

- only observable actions can be recorded;
- there is no recourse to concurrent silent thinking;
- there is no ability to standardise the complexity of the observed user's needs therefore it is difficult to compare findings across professions and settings;
- an assessment may involve collaborative working with another professional.

Observation of the participants assessing a service user, either one of their own service users or researcher-selected users was also considered. The use of actual users would have enabled the participants to follow their usual assessment procedure and obtain contextual, kinaesthetic and sensory information. Sourcing of the participant-selected users would potentially influence participant objectivity. If the participants were to source their own service users against a set of specified criteria it would have been difficult to control the variables across the 19 research sites. Extraneous and uncontrolled variables would have made it difficult to interpret the findings and potentially affect the reliability and validity of the results. From a methodological perspective it would not have been possible to undertake concurrent thinking aloud in the presence of the users for the reasons discussed in section 2.6.1 and therefore accessing the participants thinking during assessment would not have been possible. The alternative possibility of using the same three service users for all participants was considered morally unacceptable as arguably it would have been of no direct benefit to them and it would have required them to spend in excess of 60 hours undergoing repetitive assessment and travelling to different parts of the country. This approach was therefore also rejected.

The main advantage of using a **survey** to enquire into clinical decision making is that it is straightforward to administer to a large number of participants in contrast to other qualitative methods. However, it is difficult to ascertain the veracity and relevance of the responses and it is dependent upon the participants' ability to reflect on their decision making in addition to being reliant upon accurate recall and is therefore open to error. It was therefore rejected as a possible methodology as it was not suitable to investigate contemporaneous cognitive decision making processes.

Interviews are dependent upon the participant being truthful and complete in their responses which are open to error, influence and bias. Nisbett and Wilson (1977) propose that participants may be unconsciously affected by a stimulus which may influence their responses and that they may not be aware that this has occurred. Participants may report what they believe they should, but may not do, and this is difficult to establish during an interview. It is also possible that the researcher may unconsciously lead the response. The presence of the researcher may influence the participant's response and it is difficult to ascertain if the information provided corresponds to the reality of clinical practice. As reported in Chapter 2, Section 2.6 interviews have been used to investigate the content and process of CDM, using a number of methodologies including grounded theory, retrospective thinking aloud and personal construct theory.

The most common type of interview used within qualitative research is the semi-structured format (Flick, 2006) as this allows the researcher flexibility to explore in detail topics which may arise during the interview and which may differ between participants. However, such flexibility can result in inconsistencies between interview data which may distort the findings. Interview was chosen for Study 1 because it was the most direct way of accessing information regarding the participant's specialist knowledge and role which enabled further probing. As the methodology is better known than concurrent thinking aloud further detail has not been reported.

Focus group methodology does not provide access to the individual thinking processes as the participants contribute to group discussion. Accessing each individual's thinking processes are essential in relation to the research aims of this study. Focus groups could have been used to generate insight into the content of decision making but the influence of the group peer pressure may have inhibited some participants and it would be difficult to ascertain if the data accurately reflected each individual's thinking or a collective groupthink. It was therefore not employed within this study.

Concurrent verbal protocol analysis, also known as thinking-aloud, was identified and selected as the most appropriate methodological design in order to investigate the process and content of decision making by tracking participants' thinking as each individual worked through a clinical problem and arrived at a solution or solutions. Fox, Ericsson & Best (2011) consider it to be a particularly suitable design when investigating a task which has a clear start and end point. The advantages of utilizing thinking-aloud for clinical decision making research are:

- it facilitates access to the participants' concurrent thinking as they undertake a problem-solving task and does so without changing the content or sequencing of thought (Fox et al., 2011);
- the verbal data can be recorded and used for later encoding;
- as a process-tracing approach based upon Information Processing Theory (Newell and Simon, 1972) it is possible to attach meaning to the underlying cognitive processes;
- it can provide information on metacognitive processing and demonstrate adaptation of processing in a top-down manner (Payne and Venkatraman, 2011).

The following section outlines the methodological issues inherent in the use of concurrent thinking-aloud and is included as adherence to the recommended procedure is important in order to ensure validity and reliability (Ericsson and Simon, 1993).

3.3.2 Methodological Issues Regarding Concurrent Thinking Aloud

Concurrent and retrospective thinking-aloud has been used extensively since the 1970s across a range of research areas. Wilson (1994) stated that "verbal protocols are an excellent methodology to study the contents of consciousness" and the thinking-aloud methodology has been applied in a number of fields, most notably in cognitive science and psychology (Nisbett and Wilson, 1977, Crutcher, 1994, Payne, 1994, Wilson, 1994); medicine and nursing (Jones, 1989, Dickson et al., 2000, Backlund et al., 2004, Skaner et al., 2005, Han et al., 2007, Durning et al., 2011); education (Pottier et al., 2010); usability testing (Krahmer, 2004, Li et al., 2012, Cooke, 2010); engineering (Hughes and Parkes, 2003, Bloxham et al., 2011); and computing (Sonnentag, 1998). Krahmer (2004) summarised the goals of think-aloud research in the field as:

1. To find evidence for models and theories of cognitive processes;
2. To discover and understand general patterns of behaviour in the interaction with documents or applications, in order to create a scientific basis for designing them;
3. To test specific new documents or applications in order to trouble-shoot and revise (usability testing, or pretesting, or formative testing).

Three main methodological concerns have been raised by researchers using the think-aloud methodology:

1. *Reactivity,* whereby the cognitive processes and response times are potentially changed as a result of thinking aloud when undertaking a task in comparison to performance in a silent condition. In their seminal work, *Protocol Analysis*, Ericsson and Simon (1993) stated that Level I verbalisations, i.e. concurrent thinking aloud should not change the underlying cognitive processes mediating verbalisations, although the response time was likely to be longer. However, reactivity would also be expected to occur during Level 3 verbalisations where the individual was providing reasons and explanations for their thinking. Nisbett and Wilson (1977) had reported concerns regarding potential reactive effects and Russo, Johnson and Stevens (1989) stated that a number of studies had demonstrated weak effects for reactivity which, when combined might be significant. Wilson (1994) restated his concerns almost two decades later and proposed that "verbal protocols are an excellent methodology to study the contents of consciousness" but additional methodologies should be used simultaneously to check for reactivity. Ericsson and Simon (1993) recommended a series of warm–up tasks and provided instructions regarding interaction with the participant during their problem-solving task, which would assist in limiting reactivity. Years later, in order to investigate reactivity, Fox, Ericsson and Best (2011) reported on a meta-analysis of 94 verbal protocol studies undertaken since 1962, which compared performance across two conditions: undertaking concurrent thinking-aloud and a matching condition without verbalisation in order to determine under what conditions thinking aloud can be carried out with minimal reactivity.

Findings based on nearly 3,500 participants demonstrated that the reactivity for concurrent thinking-aloud (Level 1 verbalisation) was almost zero (r=0.03) regardless of task type – visual or nonvisual. However, studies which require participants to explain or describe their thoughts (Level 3 verbalisations) or actions are highly reactive. All verbal reporting procedures tended to increase the task completion times due to time taken to verbalise thoughts.

2. *Completeness of the verbal protocol*. Ericsson and Simon (1980, 1993) state that during concurrent thinking aloud thoughts which are attended to within the STM are verbalised. Such verbalisations do not describe the details of the information nor why they are the focus of attention. Their model of thinking-aloud presupposes that verbal reports may be incomplete as the verbalisation of thoughts is secondary to the completion of the problem-solving task. They purported that processes which have become automatic and are no longer subject to interpretation do not become the focus of attention in the STM and cannot therefore be captured during thinking aloud. A number of authors (Barkaoui, 2011, Hayes et al., 1998, Schooler et al., 1993, Bainbridge, 1979) suggest that the verbal protocols are inherently incomplete as they cannot capture non-conscious processing, such as "automaticity, implicit learning, implicit memory, on-line processing, priming, and intuition" (Wilson, 1994) and recommend that a multi-method approach should be employed if these aspects are of interest to capture (Payne and Venkatraman, 2011). Such methods may include tracking of eye movements (Elling et al., 2012, Lohse and Johnson, 1996, Just and Carpenter, 1976) and computerized process tracing, such as Mouselab (Payne et al., 1993) and MouseTrace (Jasper and Shapiro, 2002). The veridicality of the verbal protocol must also be considered and although this is more of an issue for retrospective thinking aloud where there is the possibility of reporting cognitive processes which did not occur, it must, nevertheless, also be considered for concurrent thinking-aloud. Nonveridicalities in this regard include errors of omission whereby the individual may not report some thoughts. In order to minimise such

occurrences, Ericsson and Simon (1993) recommend that the researcher instruct the individual to “keep thinking aloud” if they are silent for more than 30 seconds. Within this study, all participants were reminded to keep thinking aloud when they had been silent for 30 seconds.

3. *Validity of the method in accurately reflecting the individual’s thinking.* Biehal & Chakravarti, (1989) commented that the physical process of thinking aloud within a social context may inevitably lead the participants to “clean up their act and to describe a more coherent and well thought-out strategy than is normal.” Similarly, Kuusela and Paul (2000) suggested that individuals may “edit their thoughts before verbalizing to make them appear more rational.” Wilson (1994) also talked about “self-presentational concerns” in relation to sensitive or potentially embarrassing subjects. In response Fox et al (2011) to such critiques states that if such issues were problematic there would be evidence of such with the verbal protocols and they would no longer present as a combination of complete and incomplete thoughts but rather a well-formed and coherent narrative. In addition, Wilson (1994) questioned if the data can be considered as reliable as other behavioural, physiological and neuropsychological objective measures such as: eye movements, skin conductivity, response times, active information search and brain scanning. However, these methods are also susceptible to reactivity and, similar to verbal protocols, procedural instructions and methods of interpretation need to be explicit (Kühberger et al., 2011). In their meta-analysis of thinking-aloud (Fox et al., 2011) conclude that “verbalization procedures [should be viewed] with the same rigor *(sic)* applied to elicitation of valid reaction times and other traditional data.” They recommend that a detailed procedural description be provided for the instructing, familiarising and reminding of participants in order to enable replication.

Within the clinical decision making literature (see Chapter 2, section 2.6 for a review of the studies) the application of thinking aloud methodology varied between the studies and undertaking a critical appraisal was helpful in developing and implementing methodological rigour within this study. None of the papers presented sufficient methodological detail to enable replication, an issue previously noted by several authors in relation to thinking-aloud studies (Carter and Little, 2007, Lundgren-Laine and Salantera, 2010). These authors stated that the primary considerations when undertaking TA should be: the methodological design which enabled participants to move from thinking aloud to explanation, the manner and frequency of verbal prompts to keep thinking aloud, the imposition of a time limit to complete the task, the use of practice tasks and the materials used. These considerations are discussed in turn below.

1. Adherence to Level 1 verbalisation: Ericsson and Simon (1993) make clear that if the participant is enabled to explain their reasoning (Level 3 verbalisation) the resultant verbal protocol is likely to become reactive and the sequence of thinking is likely to be different from silent thinking. If the design of the study is to generate thinking aloud only (Level I verbalisation), then procedures should be closely observed in order to accomplish this. For example, the wording of the verbal prompts should request that the participant "keep thinking aloud" instead of the more conversational "tell me what you were thinking". Studies by Greenwood and King (1995), Tanner et al. (1987) and Offredy (2002) differed from the recommended protocol for capturing thinking-aloud verbalisations and it is likely that the resultant protocols are a combination of Level I and Level 3 verbalisations. Greenwood and King (1995) requested that their subjects "selectively filter from their verbal reports any potentially distressing information" while thinking aloud during routine clinical intervention and Tanner et al. (1987) and Offredy (2002) requested that their participants outline their reasoning for requesting further information and their interpretation of such information.

2. Verbal prompts: there was no consistency regarding the frequency or language used when prompting the participants to keep thinking aloud. Funkesson et al. (2007) and Twycross and Powls (2006) only report that prompts were given when the participants were silent, Offredy (2002) and Skaner et al. (2005) provided prompts after 15 seconds of silence

whereas Prime and Le Masurier (2000) allowed 30 seconds of silence. Ericsson and Simon (1993) do not specify a particular timeframe but do recommend that the vocabulary used when prompting does not invite conversation.

3. Time limit: when undertaking a problem-solving task the process of thinking aloud slows the response times (Ericsson and Simon, 1993, Fox et al., 2011). The imposition of a time limit in which the participants needed to complete their thinking aloud may, therefore affect the accuracy and completeness of their response. Fox et al. (2011) in their meta-analysis of thinking aloud studies, concluded that "imposing time limits might lead to lower accuracy in think-aloud conditions even though no accuracy differences between think-aloud and silent would be observed in the absence of time limits." Within the clinical decision making literature several researchers imposed time limits upon thinking aloud but did not report any deficiency in either the completeness or accuracy of the responses. Tanner et al. (1987) applied a time limit of 20 minutes whereas Grobe et al. (1991) and Han et al. (2007) allowed 30 minutes. The imposition of a time frame should be suitable for the task and the same time allowed as if it were completed within clinical practice.

4. Practice tasks: the studies differed in their application of thinking aloud practice tasks. Greenwood (1995) and Cioffi (1997) implemented the practice tasks as suggested by Ericsson and Simon (1984, 1993) which included mental arithmetic tasks, counting windows within a house and naming 20 animals. Twycross and Powls (2006), Prime and Le Masurier (2000) and Offredy (2002) also included a practice case scenario task similar to that which the participants would be undertaking in the actual study. Providing participants the opportunity to practice thinking aloud is crucial in enabling them to differentiate between thinking aloud, description and explanation and establish an acceptable degree of accuracy.

5. Materials: simulated verbal (Jones, 1989, Cioffi and Markham, 1997, Offredy, 2002) and written case scenarios (Tanner et al., 1987, Grobe et al., 1991, Lamond et al., 1996b, Redden and Wotton, 2001, Skaner et al., 2005, Twycross and Powls, 2006, Funkesson et al., 2007), patient's clinical notes (Fowler, 1997), videotaped simulated acted scripts (Prime and Le Masurier, 2000) and assessment and treatment within real-life clinical settings (Fisher and Fonteyn, 1995, Greenwood and King, 1995, Han et al., 2007, Aitken et al., 2011) were the designs employed in these studies. The rationale for the selection of the design was not always clearly articulated for each paper and in a number of studies the presentation of the case scenarios were not randomised (Offredy, 2002, Skaner et al., 2005) and the potential impact of learning effects was not addressed. A review of alternate methodologies considered for this study is presented in the following section.

One of the aims of this research was to enquire into the tacit and unconscious cognitive decision making processes used as participants solved a clinical problem-solving task. Concurrent thinking- aloud was identified as the most appropriate methodology in order to achieve this aim as it enabled the participants to think through a clinical situation with which they were familiar without any demands for personal introspection. When undertaken with scientific rigour, adhering to the recommendations outlined by Ericsson and Simon (1993) TA can produce an accurate record of the participants thinking. The resultant verbal protocol provides detailed information and although data analysis is time-consuming, to date it appears to be the optimum method for investigation of the thinking process.

3.4 Participants

3.4.1 Population Sample

A purposive sample of 60 professionals was identified and participated in studies 1 and 2.

3.4.2 Selection of Professions

Correspondence with NHS Assistive Technology and Augmentative and Alternative Communication (AAC) services within England indicated that multidisciplinary team composition differs across the country. Organisational structure, funding and their role and purpose appears to dictate the team composition. The majority of AT teams have at least one biomedical engineer and one occupational therapist. If a speech and language therapist is not part of the same team there is often close liaison with the local AAC service. Physiotherapists may also be part of the team but this is infrequent. Correspondence with brain injury units suggested that it is the OTs and SLTs who assess for and recommend EAT.

The three professions selected for study were those who are most frequently involved in the assessment, provision and ongoing management of EAT throughout England for acquired brain injury (ABI). Not all settings had a medical consultant or physiotherapist involved in EAT.

3.4.3 Rationale for Sample Size

Qualitative research studies typically reflect small sample sizes as the underlying premise is to develop an in-depth understanding of the subject. Kuipers and Kassirer (1984) stated that “a methodology of discovery appropriate to the undoubted complexity of human knowledge requires rich data about individuals rather than easily analysed data about a population.” Frequency measures are of less importance than in quantitative research as the researcher is concerned with meaning and not the development of a hypothesis (Mason, 2010). Within the clinical decision making literature and thinking aloud in particular, sample size ranges from one participant (Fonteyn and Fisher, 1995) to 61 participants (Denig, 2002). In order to ascertain if there were differences and similarities between the professions it was necessary to achieve data saturation within each profession. Naturally occurring limits to sample size included the size of pool of potential participants given the specialist nature of the job and the length of time available within the PhD programme for data collection and analysis. Information from an informal fact-finding survey regarding potential size of the participant pool indicated that it would be possible to recruit 20 participants from each profession. This would provide a representative and almost exhaustive sample.

3.4.4 Representativeness of Sample

Working with EAT requires specialist knowledge and skills. It was hypothesised that participants working with EAT within a brain injury unit were less likely to be an EAT specialist but would have a working knowledge of the field, while professionals working in EAT centres might lack specialist knowledge about brain injury. Using both sources of professionals ensured using all service providers.

3.5 Procedure

3.5.1 Reflexivity

Within qualitative research the influence of the researcher's presence and, in this instance, her profession, was taken into consideration and acknowledged that it may have had an effect on the participants' behaviour (Kuper et al., 2008). In order to minimize such an effect the researcher made no reference to her profession as a speech and language therapist during her contact with participants. Because the EAT field is so small, eight participants were aware of her professional background and in such instances she was vigilant not to converse as a SLT but rather as the researcher.

3.6 Materials

In order to choose how best to access the participants' underlying cognitive reasoning processes during decision making, the use of standardised patients, footage and case scenarios of real-life service users and service user simulation were explored. The justification for rejection or selection is outlined at the end of each section.

3.6.1 Expertise rating scales

In order to investigate the participants' self-perception of their level of expertise the Dreyfus Model of Skills Acquisition categorical scale (Dreyfus and Dreyfus, 1986) was identified as a model which was well known within the nursing (Benner, 2001) and medical fields (Peña and Kiran, 2008, Carraccio et al., 2008, Pena, 2010) and would also be appropriate for the participants in this study.

3.6.2 Interview schedule

The interview questions were derived from considerations based on the MPT (Scherer and Craddock, 2002) and clinical practice regarding the specialist knowledge and role.

3.6.3 Standardised Patients

Standardised patients (also interchangeably known as simulated patients in the literature) are frequently used within the education of health professions (Wallace et al., 2002, Ladyshewsky and Gotjamanos, 1997). The standardised patient (SP) is typically trained to provide a standard response to questions regarding one particular illness or disorder and often provide feedback on the professional's performance. The use of SP within the CDM literature is limited and is mainly within medicine. SPs have been reported within medical research in order to develop and evaluate the doctor's skill and decision making. Brown et al. (2005) piloted the use of paediatric SPs for training complex interviewing skills; O'Hagan et al. (1986) evaluated clinical performance, Clever et al. (2003) assessed informed decision making skills; Terry et al. (2007) investigated diagnostic decision making and Feldman et al. (1997) investigated the impact of patient characteristics such as race, sex and gender on decision making. A recent nursing study employed actors to simulate two deteriorating patients in order to examine CDM skills (Endacott et al., 2012). The use of standardised patients requires the performance to be valid and reliable in different situations and a significant amount of training would have been required to ensure a realistic portrayal of complex service users (Norman et al., 1985).

Extensive training, observation of real patients and rehearsal would have been required including the creation of an extensive script to allow for all eventualities they may have been put in by the participants. Given the complexity of the physical, cognitive and communication disorders of the simulated user there was a large risk regarding a potential lack of fidelity as the requirements may be too complex to act convincingly and the actor going off-script inappropriately. It would also have been prohibitively expensive as the same two actors would have been required for 60 performances in different parts of England in order to ensure repeatability. The method was therefore rejected as it would have been difficult to ensure reliability and validity of performance.

3.6.4 Footage and Case Scenario of Real-Life Service User

Development of a case scenario with footage, based on a real-life user was investigated in order to ensure ecological validity. There are no reports of such material within the CDM literature. Identification of a minimum of three users would have involved liaising with potential participants and may therefore have influenced their objectivity in approaching the task during data collection, for which they would have had to be excluded. Due to the specialist nature of EAT provision for individuals with complex acquired brain injury there was a high risk that the individuals may be recognised and any changes in the reporting of their biographical details or abilities may have negatively impacted upon the content validity of the scenario. However, the possibility of the participants seeing the users' physical abilities and hearing their speech was considered to be a significant advantage. Ultimately, this approach was rejected due to the risk of user identification by the participants and possible problems with validity.

3.6.5 Case Simulation

Case simulations are designed to present a life-like situation whilst controlling for extraneous variables (Holzemer et al., 1986) in order to approximate a real clinical situation. Established criteria for the development and validation of case simulations for use within research does not yet exist but a number of studies in health research report on the equivalency of simulation to real life (Fielding and Page, 1978, Holzemer et al., 1986, Holzemer and McLaughlin, 1988). While it is inevitable that a clinical simulation cannot exactly replicate a real life situation (Jones, 1989, Elstein et al., 1990), it is crucial that adherence to content, construct and ecological validity seek to minimise any difference. The use of case vignettes and scenarios allows standardisation of material across the participants thereby enabling comparisons within and between participants. The disadvantages include lack of access to kinaesthetic and sensory information in addition to contextual factors. Within the CDM literature case simulation literature variations are reported in the

i. method of delivery;
ii. the extent of information presented;
iii. the use of real clinical data;
iv. the inclusion of simulated video footage.

The use of scenario and vignette variations was evaluated and is detailed below in order to ascertain if either were appropriate to answer the aims of the study.

1. There are the two primary methods of presenting information, *response-based and process-based* (Rimoldi, 1988, Patel and Groen, 1986) within clinical simulations and it is essential that the selected method adheres as closely as possible to clinical practice. In response-based, the participant has no control over the content or timing of information presented and their thinking may therefore be altered as they receive information which they may not have sought had they been in control. The validity of this method has therefore been questioned (Norman and Feightner, 1981). In contrast the process-based method enables the participant to request further information, the content and timing of which is under their control. Cioffi (2001) stated that simulated clinical

situations that incorporate a process-based method can be designed to attain a high degree of representativeness of actual clinical situations." The process-based approach was deemed to be the most appropriate for this population and was therefore selected.

2. A number of clinical decision making studies used *written clinical vignettes* to investigate selection of appropriate predefined treatment, diagnosis or discharge (Rassafiani et al., 2006, Jette et al., 2006, Jones, 1989, Skaner et al., 2005, Reich et al., 1998). Vignettes are brief and could not provide enough depth for the complex ABI cases that were planned and were therefore rejected.

3. More detailed *written case scenarios* have been used in combination with thinking aloud to investigate clinical decision making (Grobe et al., 1991, Redden and Wotton, 2001, Denig, 2002, Skaner et al., 2005, Funkesson et al., 2007). All these authors, apart from Redden and Wotton state that they intentionally presented the written information in an order and format familiar to the participants' clinical practice and asked the participant to think aloud without recourse to any further information.

4. *Verbal case scenarios* have also been employed where researchers have verbally presented the case scenario data and required the participants to ask questions in order to request further information to assist with diagnosis (Jones, 1989) for assessment and diagnosis (Cioffi and Markham, 1997) and for diagnosis and treatment (Offredy, 2002) as they would in clinical practice. Jones (1989) also allowed the participants to make notes. Twycross (2006) expanded upon the written-only case scenario by providing access to clinical data upon request, such as a drug chart and nursing history sheets and the ability to ask questions.

5. Cioffi and Markham (1997) and Funkesson et al. (2007) based their simulation on real patient data, as did Tanner et al. (1987) and Lamond (1996) and they also included a verbal shift-handover report, the

patients' medical records, a videoed patient simulation and the participants were able to ask questions. An investigation into the information sources that nurses use in decision making, (Lamond et al., 1996a) discovered a hierarchy whereby verbal information, that is any information gained from talking to the patient, family or other professionals was the most important; observation and prior knowledge (including experience and education) were followed by written information. They concluded that nursing simulations which contain only written information are not an accurate reflection of reality and therefore compromise face validity. No such research has been carried out with the professions in this study but assessment for EAT requires observation of the users physical abilities in order to, at a minimum, isolate a reliable movement for operating the technology (Cook and Hussey, 1995, Scherer, 2011). For this study it was considered that the sole use of written simulations would negatively affect ecological validity. The simulations devised by Tanner et al. (1987) and Lamond (1996) were considered to closely reflect clinical practice because they enabled the participants to use a range of modalities in order to assess the patient. The materials devised for this study adapted and extended those previously used by Lamond et al. (1996b) and Tanner et al. (1987). In order to answer the research question, written case scenarios, simulated footage of physical abilities and a real-life service user speech sample were selected as the most real-life, standardised and complete materials.

3.6.6 Content of Case Scenarios

The format and content of the case scenarios were designed to closely simulate clinical practice in order to ensure ecological validity. The justification for each component is provided in separate sub-sections.

3.6.6.1 Rationale for Selection of Acquired Brain Injury Population

In order to investigate the content and process of CDM within the three professions it was essential to select a clinical population with whom all participants would be equally and typically involved. The key considerations for which each potential service user population was evaluated were:

- stability or degenerative nature of the condition;
- potential involvement of cognition;
- presence and extent of a speech and language disorder;
- presence and degree of physical impairment;
- probable need for EAT;
- probable need for a wheelchair;
- incidence and prevalence of referral for EAT.

Disorders which were considered and reviewed included cerebral palsy, spinal cord injury, multiple sclerosis, Parkinson's disease, motor neurone disease, cerebral vascular accident and acquired traumatic brain injury. Typically all three professions are involved with each disorder to an extent and often at different times. There is little published information regarding the incidence and prevalence of individuals with each disorder accessing EAT. A telephone survey of the assistive technology centres within England in 2007 indicated variation in the caseload profile and it became apparent that acquired brain injury and cerebral palsy were the disorders for which the three professions most commonly worked together. However, it was frequently the neurological degenerative disorders which had the greatest incidence and prevalence per service, which is reflective of the findings from Taylor-Goh et al. (2008) who found that 42% of the service users within a population of 7.1 million presented with multiple sclerosis, Parkinson's disease and motor neurone disease. Acquired brain injury was selected as the clinical population as there was greater opportunity to source participants than in services for adults with cerebral palsy. The variation in symptoms subsequent to an acquired brain injury also enabled the development of case scenarios which were challenging to all three professions yet ecologically valid.

3.6.6.2 Written Case Scenario

Two versions of the written case scenarios were developed, one for participants and one for the researcher. The expanded researcher's version contained a complete case history of each individual in order to ensure standardisation when answering the participants' questions. The aim was to create case simulations where the effects of suffering a traumatic brain injury resulted in the need for EAT provision but the individuals in the cases differed in as many ways as possible. An acquired brain injury can result from trauma, a vascular accident, cerebral anoxia, toxic or metabolic insult or infection (RCP and BSRM, 2003) and the severity is measured by the Glasgow Coma Scale (GCS) score on admission to hospital and the length of coma or post-traumatic amnesia. Depending on the score, head injuries are classed as: minor: a score of 13 or more; moderate: a score of 9-12 and severe: a score of 8 or less. However, such classifications do not predict the actual long-term outcome and Turner-Stokes (2003) considers them to be "weakly related". Based upon the GCS score, each case simulation would be classified as having a severe head injury. In the UK, 70-88% of all people that sustain a head injury are male (NICE, 2007). Assaults (30-50%) and road traffic accidents (25%) are two of the most common causes of minor head injury (Wasserberg, 2002). Road traffic accidents account for a high percentage of moderate and severe head injuries according to the National Collaborating Centre for Acute Care (2007) report. In order to reflect these statistics, the simulation cases were of two men and one woman. In two of the simulations the TBI was caused by a road traffic accident and the third was caused by an assault. The pattern of deficits manifested after traumatic brain injury are diverse and are related to the location of damage within the brain. Each of the simulations displayed varying cognitive, communication and physical impairments as the underlying pathology differed between each case. Each case was carefully constructed to ensure that the specific combination of the aforementioned impairments were clinically accurate and had content validity. The validation process is detailed below in section 3.6.7.6.

The participants' version contained representative referral information, including biographical details, medical history and status, physical and communication abilities, and were presented in a generic clinical format, familiar to all participants. There is no standardised method of referral used within EAT and the referral documentation of each of the 19 sites differed in procedure and format but all sites included the information as contained within the participant's case scenario.

The content of the researcher's version was generated based upon two of the three elements which form the core of the Matching Person and Technology model (MPT) (Scherer and Craddock, 2002), a framework designed to ensure an individualised and person-centred approach to the provision of technology. The MPT and similar frameworks are used within clinical practice in England. All factors from the *Personal and psychosocial characteristics, needs and preferences* element were included and addressed:

- needs, capabilities and preferences;
- prior support use;
- motivation and readiness;
- expectations;
- mood and lifestyle.

All *environmental factors* were included and addressed:

- personal and social environment;
- built environment;
- cultural and physical environment;
- attitudinal and economic and legislative and political.

The *functions and features of the technology* element was not included as this was generated by the participants during the thinking-aloud task as they assessed the case and arrived at a prescription.

An outline of the content and the practice case scenario are presented later in this chapter and the full case scenarios are available in Chapter 6.

3.6.6.3 Assessment Results and Outcome Measures for the Case Scenarios

Outcome measurement tools for brain injury rehabilitation are often domain-specific) (Crewe and Dijkers, 1995) in order to capture specific clinical detail and do not display the interrelationship and impact of one domain upon another, for example, cognition and communication. The Functional Independence Measure (FIM) and Functional Assessment Measure (FAM) (Turner-Stokes et al., 1999) seek to address this by combining a number of domains to provide an overall measure of disability that is widely used in the UK. Mermis (2005) proposed a taxonomy for rehabilitation outcomes based on integrative levels whereby the domains are organised to indicate conceptual interdependence and recognition of the influence each domain has upon another which is a helpful framework for multi-disciplinary working.

Conversations with OTs and SLTs working within brain injury units indicated that there were a number of scales and measures regularly used within clinical practice which would be appropriate for inclusion. Results of assessments and outcome measures were created demonstrating each individual's status at time of discharge in order to maintain fidelity to clinical practice, which in turn assisted with ecological validity.

1. Assessment of mood status:
    - Becks Depression Inventory-II (Beck et al., 1996)
    - Hospital Anxiety and Depression Scale (Zigmond and Snaith, 1983)

2. Assessment of visual perceptual ability, important for effectiveness and safety of using a powered wheelchair; physical placement with mounted devices and the screen layout.
    - The Rivermead Perceptual Assessment Battery (Whiting et al., 1985)

3. Assessment of eight different motor functions across upper and lower limbs, on a scale of 0 to 6.
    - Motor Assessment Scale (Carr et al., 1985)

4. Measurement of the impairment, activity limitation, participation restriction and level of well-being and distress across a range of measures within OT,

physiotherapy and SLT. As it is most frequently used within SLT, only the measures for aphasia, dysarthria and apraxia were included.

- The Therapy Outcome Measures (Enderby et al., 2006)

5. Global functional abilities across 30 parameters encompassing ability to self-care, continence, mobility, communication, psychosocial adjustment and cognitive function.
   - Functional Assessment Measures (UK FIM + FAM) (Turner-Stokes et al., 1999)

3.6.6.4 Video Footage

Clinical assessment for EAT involves observation of and interaction with the user in order to analyse their abilities and needs. The strength and range of movement, muscle tone, positioning during seating, and the intelligibility of their speech are some of the aspects addressed. Tertiary assessment centres request that referrals to their service be accompanied by a written report and, if possible, footage. In order to provide participants with maximum multisensory information, footage was filmed of an actor demonstrating the physical characteristics of each case scenario individual. This approach was adapted from research by Tanner et al. (1987) and Lamond et al. (1996b). The actor was a physiotherapist, specialising in acquired neurological disorders with over 20 years' experience. It was important that the actor had a clinical understanding of the movements required in order to demonstrate them as realistically as possible. Close collaboration with occupational therapists and physiotherapists otherwise uninvolved in the study resulted in the development of a script for filming. It was essential to view the actor in a wheelchair and see the full range of movement commencing at the head and finishing at the feet. See Chapter 6, section 6.4 for content of footage and Appendix 1 (DVD) for the actual footage.

3.6.6.5 Audio Content

In order to reflect real life, 30 second samples of dysarthric and apraxic speech, a different one for each the case scenario, were included. It can be difficult to "hear" a written description of disordered speech unless very familiar with speech disorders, therefore, to prevent errors, the inclusion of a speech sample was considered necessary. These samples were of conversational speech and demonstrated the typical features of flaccid dysarthria, spastic/ataxic dysarthria and apraxia.

3.6.6.6 Validation of Case Scenarios

Norman et al. (1985) report on the need to consider the fidelity, reliability and validity of case simulations in order to ensure construct, content and ecological validity. The video- and audio- enhanced case scenarios were reviewed by a panel of professionals working within the field of electronic assistive technology and acquired brain injury. This method is recommended in the development of case simulations and within clinical decision making it was used by Prime and Le Masurier (2000) in the development of their videotaped scripts. The panel for the present study consisted of 16 professionals representing eight professions in order to ensure that all aspects of the content were critically appraised. The panel was composed of:

- a Rehabilitation Consultant who, in addition to his clinical position also held a senior role within an assistive technology unit;
- four physiotherapists, two SLTs, a social worker, and a neuropsychologist working within acquired brain injury;
- two OTs and two SLTs working within acquired brain injury and assistive technology;
- a pharmacist from a regional drug information service, and
- two BEs working in an assistive technology service.

The professionals worked across a variety of settings within England and Ireland and were personally known by the researcher or her supervisors and were invited to participate in this capacity only. Their work settings included NHS hospitals, NHS community services, private clinical practice and assistive technology services.

Each panel member was sent the enhanced case scenarios, for both the participants and researcher, and asked to comment upon:

1. The clinical accuracy - are all the clinical details accurate given the medical diagnosis?
2. The clinical realism - are these scenarios typical of what you might see in clinical practice?
3. The internal consistency - are the presenting symptoms consistent within each scenario?
4. The completeness of each case - is there any missing information which you would consider essential?
5. The appropriateness and usefulness of the outcome measures - are there others which would usefully add to the detail and are in common use?
6. Clarity of language and low potential for ambiguity.

Comments were received from all professionals and adjustments were made to the written documentation accordingly. The revised written case scenarios were returned to all panel members for further comment and an iterative process was undertaken until all written case scenarios required no further adjustments.

3.7 Data Analysis

3.7.1 Data Preparation: Analysis of Variance (ANOVA)

In order to reduce the likelihood of an order effect, the presentation order of the case scenarios was randomised throughout the study. To ascertain if any order effect had occurred, an ANOVA was performed. The ANOVA compared the mean counts of each of the cognitive decision making process codes between case scenarios, for all participants. In this test the null hypothesis was that the variation that may exist between the number of occurrences of each code used was no different between case scenarios 1 and 2. To ascertain if there were significant differences in the length of the think-aloud protocols between the different participants, a second ANOVA was performed. It compared the total number of coded segments per case scenario between all participants. In this test the null hypothesis was that the variability in the total number of codes used was no different than that due to normal variation within the participants. The ANOVA results are in Chapter 7, Section 7.2.

As ANOVA is a parametric test, and since some of the data were not normally distributed those variables required transformation before running the ANOVAs described in the previous paragraph. A square root transformation was found to be the most appropriate (Roberts, 2008).

3.7.2 Chi Square

The Chi Square test was used to examine the relationships between a number of categorical variable groups. It has been used within many clinical decision making studies to examine the associations between groups (Lamond, et al., 1996; Rassafiani, Ziviani, & Rodger, 2006; Reischman, 2002; Unsworth, 2001). In the present study the categorical variable groups were: whether the participants worked at EAT centres or brain injury units, whether the participants classed themselves as beginner, advanced beginner, competent, proficient or expert, the years of experience of the participants and the participants' professions. In section 6.5.3 the Chi Square tests examine whether the thinking-aloud variables' output is associated according to these categorical groups.

3.7.3 Transcription and Segmentation of the Verbal Protocols

As a process-tracing approach, incremental analysis of the inference and abstraction of the thinking-aloud data is required. Patrick and James (2004) propose that process-tracing involves at least four stages for complex cognitive tasks:

- data collection;
- transcription, integration and segmentation of data into a time-line account;
- coding using cognitive categories;
- further analysis and representation of data.

Verbatim transcription of all the data is essential in order to ensure reliability and avoid bias such as sections being intentionally selected or misinterpreted out of context. The majority of thinking-aloud studies within CDM do not report upon their transcription format and the level of detail included, which makes it more difficult to interpret and accept their findings with confidence. This omission was also noted by Patrick and James (2004). Evers (2011) states that she believes “pragmatic transcription” is most widely used in which the researcher creates and defines *a priori* their own individual transcription format, based upon the needs of the study. Gibbs (2008) warns that transcription introduces potential difficulties in relation to accuracy, fidelity and interpretation. Within this study in order to ensure that the resultant verbal protocol demonstrated fidelity in relation to the participant’s intended meaning, selected paralinguistic information was also included in accordance with the well-established Jefferson Transcription System (Jefferson, 2004). It is most often applied in interactional research such as conversation analysis, and seeks to include non-linguistic aspects of speech such as pauses, intonation and stress. The Jefferson Lite System transcribes the major paralinguistic features such as stress and intonation and leaves more subtle features such as pauses and timing unrecorded (Poland, 2001, Willig, 2001). Using the full Jefferson Transcription System was considered unnecessary as the purpose of the verbal protocol was to record the participant’s thinking aloud and not their conversational interaction. The transcription method used within this study was an expanded version of Jefferson Lite as pauses were also recorded as they are an important element of the individual’s thinking process. (See Appendix 2 for transcription guide).

Segmentation, the process of dividing the verbal data into meaningful chunks, enables coding to take place. The procedure used to determine how and where to segment the data is dependent upon the research design and the nature of the cognitive activities being coded. As segmentation prepares the data for coding and subsequent analysis any deviation from the predetermined segmentation protocol can impact upon the analysis. The publication of Ericsson and Simon’s (1984) seminal work in protocol analysis, which outlined segmentation criteria, has become a very widely used method within the field of CDM. They state "under the assumptions of our information processing model, the appropriate cues for segmentation are pauses, intonation, contours etc., as well as syntactical markers for complete phrases and sentences – the cues for segmentation in ordinary discourse" An alternative thematic method was proposed by Chi (1997) who outlined her method for segmenting verbal data, making it clear that while there are superficial similarities between verbal protocol analysis and verbal analysis, i.e. segmenting and coding, they are fundamentally different in their theoretical outlook. Protocol analysis seeks to examine the process undertaken during a problem-solving task whereas verbal analysis seeks to find meaning from the content. However, aspects of her method of determining how to segment can be applied equally to both approaches. She proposes that segmentation can take place at a micro or macro level such as a clause, phrase, an idea, a sentence, a paragraph. This criterion therefore extends the syntactic features beyond the sentence level proposed by Ericsson and Simon (1984), which is more appropriate for thematic content coding rather than analytical coding. The key consideration is how the type of segmentation implemented corresponds to the research question asked. Within clinical decision making the majority of studies use Ericsson and Simon's (1984) criteria for segmentation, adopting either the suprasegmental or syntactical features approach. Kuipers and Kassirer (1984), Goransson et al. (2007) and Fonteyn and Fisher (1995) used nouns and noun phrases and Arocha et al. (2005), Backlund et al. (2003) and Jones (1989) used clauses and statements. Within this study the Chi (1997) approach was used for thematic analysis of content and the Ericsson and Simon (1984) approach for the analytical analysis of the process of CDM.

3.7.4 Coding of the Verbal Protocols

Each verbal protocol was coded four times in order to investigate the content and process of decision making (Figure 3.1). The reasons for this repeated coding and process of how it was done are presented below.

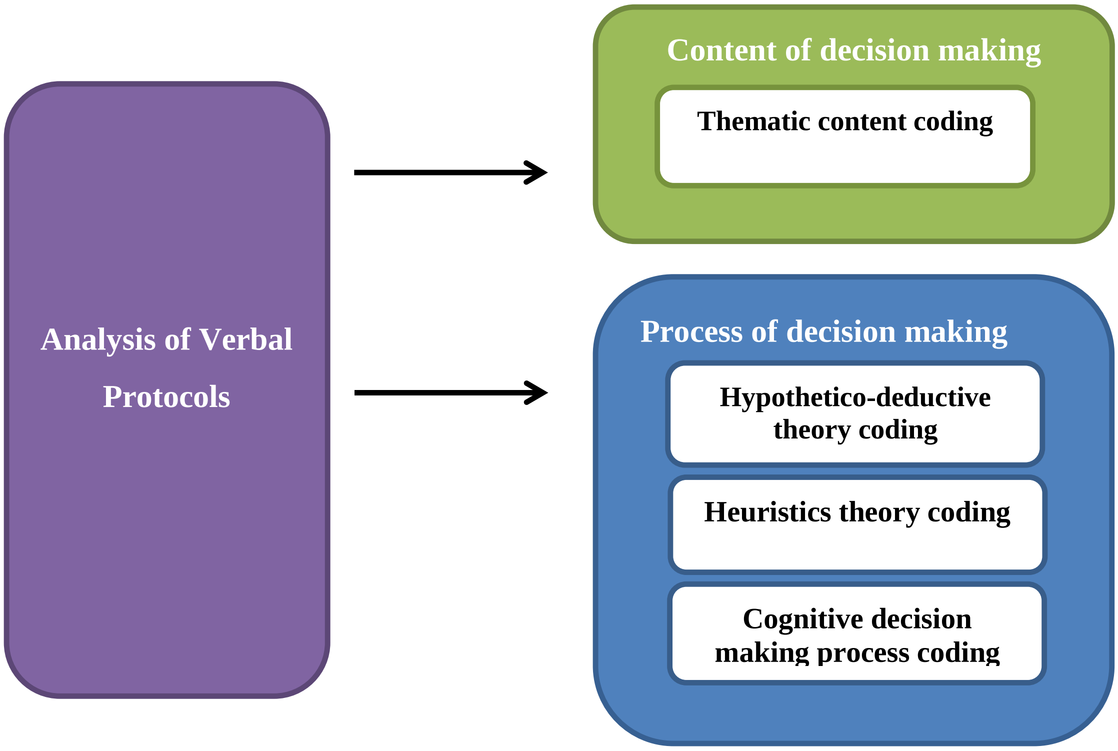

Figure 3.1: Overview of Full Coding Procedure for Analysis of the Content of CDM Using Think Aloud

3.7.4.1 Coding for Content of Decision making

Analysis of qualitative verbal data requires conversion of the raw data into theoretical categories dependent upon the philosophical assumption upon which the research is underpinned. The process of encoding enables the researcher to apply labels to segmented data either from a data-driven or a concept-driven perspective (Gibbs, 2008). The data-driven approach allows the codes to emerge from the data without the imposition of an *a priori* theoretical framework whereas in the concept-driven approach coding codes assigned to the segmented data have been derived from or are based upon

existing literature, research or from the theoretical underpinnings of the concept being explored. The process of coding undergoes a number of stages and Gibbs (2008) outlines three levels of coding, descriptive, categorical and analytic, which involve increasing levels of abstraction from the data. In order to study the content of CDM a data-driven approach was adopted in order to be responsive to the content of the data. Upon initial reading of the data a large number of codes (descriptive coding) may be assigned throughout the transcript. The next level involves the development of categories (categorical coding) into which the descriptive codes are mapped thereby making associations between the descriptive codes. The third stage of the coding process is analytic coding which requires the development of concepts to which groups of categories can be mapped. This three-stage process enables different levels of abstraction to emerge from the data. Figure 3.2 provides a schematic view of the process.

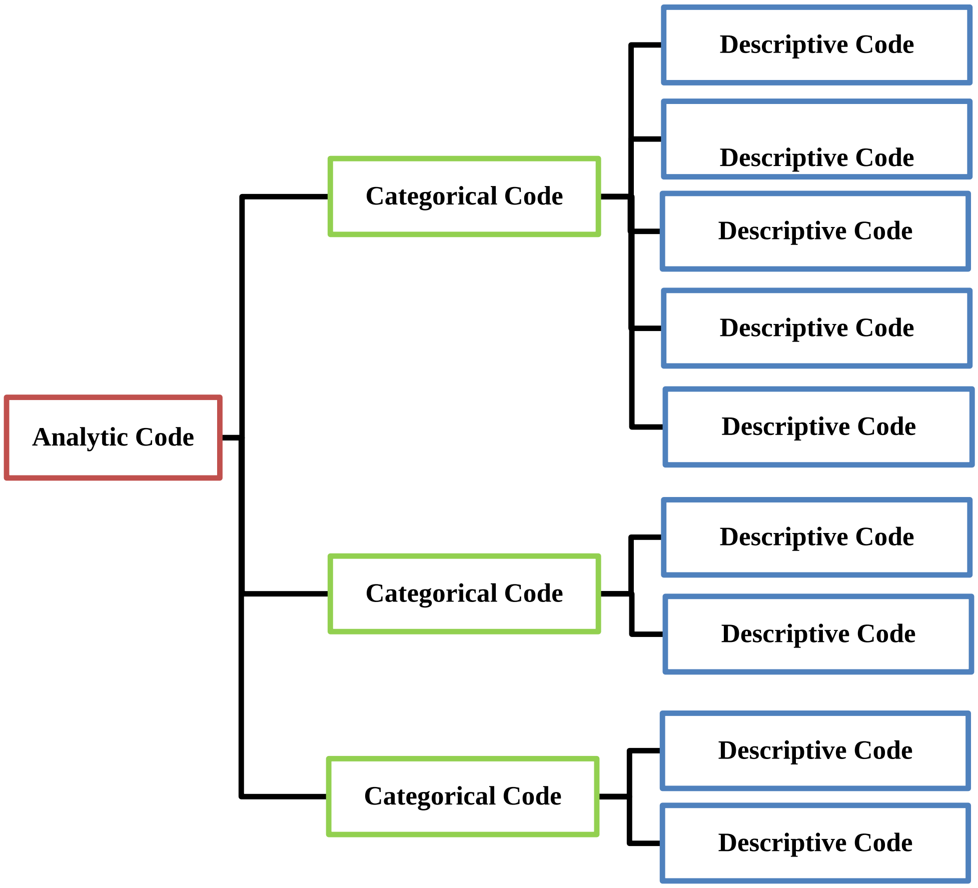

Figure 3.2: Overview of Coding Procedure for Analysis of the Content of CDM Using Think Aloud

3.7.4.2 Coding for Process of Decision making

a) Hypothetico-deductive theory and Heuristics theory

The hypothetico-deductive model has been utilised within medicine (Elstein et al., 1978) and within OT (Fleming, 1991, Roberts, 1996b) as reported in Chapter 2, Section 2.3.2.1. The application to EAT was of interest as it has not been researched.

b) Decision making Process Codes

An examination of the CDM literature revealed that decision making process coding frameworks were initially generated by Jones (1989) within a nursing study. Subsequent researchers, all within nursing, adjusted and expanded her initial coding framework according to their research aims or generated similar categories. Table 3.1 presents a synthesis of the frameworks and has been constructed from interpretation of the codes, based upon the definitions provided in the literature. Codes which demonstrate equivalency or similar features are displayed on the same row. In order to analyse the current data, a preliminary coding framework with definitions was created based upon the codes generated by Jones (1989), Greenwood and King (1995), Lamond et al. (1996b), Fowler (1997), Simmons et al. (2003), Twycross and Powls (2006) and Han et al. (2007). The codes were applied and adjustments made to the definitions to accommodate non-nursing data. The original codes used in the present pilot study are in Table 3.1 below. Additional codes were generated from the data in order to ensure that no segment was left uncoded, making the codes mutually exclusive and exhaustive. The pilot study of the use of the codes was discontinued after theoretical saturation (Strauss and Corbin, 1998) of the data occurred and no further codes emerged. The emergent framework had 12 codes. The final codes are presented in Table 4.1 in Section 3.11.2.

Table 3.1 The Process Coding Frameworks from the Literature

	Jones 1989	Greenwood and King 1995	Lamond 1996	Fowler 1997	Simmons 2003	Twycross 2006	Han 2007
Codes with Similar Features Assigned the Same Row				Connecting			
	Collect data	Collect	Read	Describing	Describe	Collect	Reviewing
	Choose (ADL)						
	Review data	Review			Conclude		Reviewing
	Interpret data	Interpret	Interpret		Explain	Interpret	Validation
	Relate data (to other ADL)	Relate					
	Diagnose	Diagnose					
	Act					Action	Action
			Goal			Goal	
			Plan	Planning	Plan	Plan	Consideration
			Evaluate	Evaluating	Evaluate	Evaluate	Validation
			Reason	Explaining		Reason	Rationalization
			Predict			Predict	
						Prior knowledge	
				Judging			Rationalization

Table 3.2 The Decision Making Process Codes and their Definition as used initially in the Pilot Study

Cognitive Decision Making Strategy Code	Definition
Collect	To acquire information from the enhanced case scenario and by asking for further details.
Formulate	To propose a course of action or intervention.
Interpret	To make sense of the data in line with currently accepted knowledge.
Judge	To make a judgment regarding the relevance in relation to the task.
Predict	To propose how the individual may be in the future.
Prescribe	To recommend a specific assistive technology solution.
Reason	To explain why a course of action has been suggested.
Review	To evaluate the course of action in the future.

c) Decision Process Graphs

Within the framework of information processing theory, Ericsson & Simon (1984) introduced the concept of problem behaviour graphs to the field of clinical decision making. Utilising concepts from the field of artificial intelligence, they introduced the concept of a node which refers to a new state of knowledge which is analogous to an intermediate problem space. This concept was applied to reasoning and the resultant graphs were called problem behaviour graphs. A problem behaviour graph is a method used to analyse and portray the thought processes as an individual thinks aloud while solving a problem. The underlying assumption is that each new thought is built upon a previous state of knowledge and therefore as the individual continues to think aloud they are continuously producing new states of knowledge. Each state of knowledge is referred to as a node (Newell & Simon, 1972) and a problem behaviour graph is a collection of nodes linked together horizontally and vertically. The vertical axis indicates when the individual needs to backtrack to a previous state of knowledge and the horizontal axis contains the strategies, which progresses one state of knowledge onto another. In this study the strategies are the cognitive decision making process codes. It is therefore possible to obtain a visual- spatial diagram of the strategies which the individual employed sequentially whilst working towards a task solution. This method has been used by two researchers within clinical decision making (Jones, 1989, Greenwood and King, 1995) and a variation has been reported by Han et al. (2007). In Jones' (1989) study it is possible to ascertain the frequency of use of the different strategies (referred to as operators) mapped against the CDM content. She stated that "the PBG wasa useful means of highlighting problem-solving behaviours of research subjects" (Jones, 1989). Greenwood and King (1995) adopted the coding from the Jones (1989) study and used it in the analysis of their data. They also used PBGs in their analysis but do not report on specific findings in their paper.

The value of a PBG is its ability to simultaneously display the cognitive processes, their content and sequencing of events undertaken within each verbal protocol. It entails an extremely time intensive process but can be particularly valuable when the main purpose of the research is to ascertain which thematic concepts were dwelt on most frequently and for how long and which cognitive processes were employed throughout the task. Han et al., (2007) investigated the serial patterns of thinking where their data was analysed into separate sequences of action and thinking. These were designated as short, intermediate and long. Although they do not refer to PBGs in their study they adopt a similar strategy for graphical presentation of the data. The vertical axis contains the cognitive strategies and the horizontal axis the thematic content. The frequency of occurrence of each cognitive strategy is marked on the graph but there is no indication of the length of time spent thinking about the coded content. The graphs present a pictorial representation of the sequence of decision making and enabled the authors to identify the short, intermediate and long patterns found within the data. Each of the studies cited above had a small cohort of participants ranging from five (Han et al., 2007) to 18 (Greenwood and King, 1995) whereas the current study had 60 participants resulting in 120 verbal protocols.

Although the value of a PBG was recognised, here the analysis of the process was done by employing a modification of the PBG called the Decision Process Graph (DPG). The purpose of the DPG is to provide a graphical representation of each occurrence of all decision making strategy codes used throughout each verbal protocol in a linear, sequential manner. This graph provides a basis for examining the sequential step-by-step progress of each participant's clinical reasoning as they arrived at a solution to each case scenario. No attempt was made to embed the length of time spent upon each code as this was not considered relevant to this study. The vertical axis shows the cognitive decision making process codes ordered with a possible beginning and end point. The horizontal axis indicates the verbal protocol character range data for each coded segment captured within NVivo to show the order in which each strategy is used. The DPG example below illustrates the cognitive decision making processes employed by Participant 53 as they were thinking aloud from the beginning to the end of the task. Dotted lines are used in order to enable ease of viewing and do not indicate continuous data. From the example below it is possible to obtain the frequency and sequencing of all cognitive decision making process codes used within this verbal protocol.

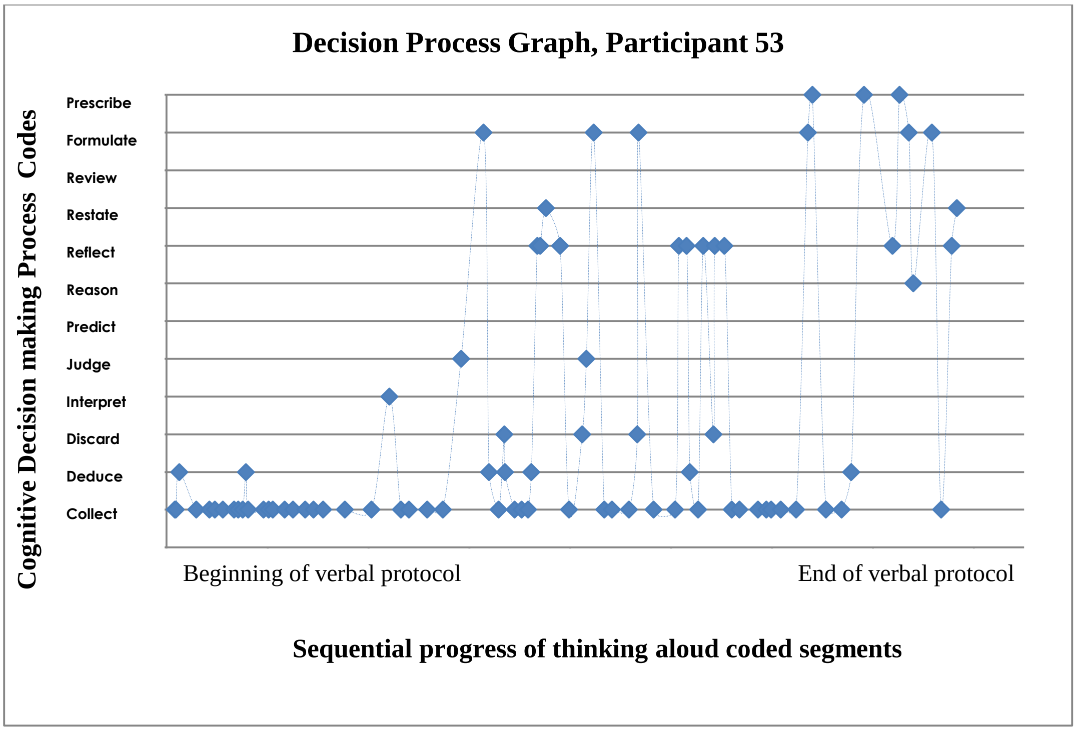

Figure 3.3: Example of Decision Process Graph Based Upon the Decision Making Process Codes

A subsidiary aim of the study was to investigate if there were differences in the decision making between expert and novice participants. Differences in the content of decision making have been identified within the medical, nursing and therapy literature (Robertson, 1996, Gibson et al., 2000, Hoffman et al., 2009) and Elstein and Schwartz (2000) reported that experts utilise their well-structured knowledge base in association with pattern recognition to ask a limited number of pertinent questions during diagnostic reasoning whereas novices are more dependent upon gathering a wide range of information in order to generate a variety of hypotheses. The DPGs were analysed in order to explore if there were patterns of decision making specific to novice and expert participants' use of the cognitive decision making process codes.

3.8 Pilot Study

3.8.1 Aims and Objectives

Subsequent to the development of the research design and procedures including validation of the case scenarios, a pilot study was undertaken. The overarching aims were to examine:

- the acceptability of the materials and procedures,
- the applicability of the codes derived from the literature to describe the decision making strategies employed

Specific objectives were to:

- examine the content and face validity of the enhanced case scenarios, including their acceptability and clarity and;
- evaluate the acceptability, clarity and reliability of the procedure, wording and reliability of administration of the interview questions and instructions to participants for the think-aloud process;
- test the appropriateness of the coding system developed from the literature to examine the cognitive decision making processes employed;
- trial thematic coding with verbal protocol data to ascertain if concepts emerged in relation to the content of decision making;
- examine whether the pilot data was congruent with models of decision making theory.

3.8.2 Participants

3.8.2.1 Sample and Inclusion Criteria

A convenience sample of seven participants, who did not take part in the main study, (BE, *n*=1; OT, *n*=4; SLT, *n*=2) were invited to participate by letter and email correspondence. The accompanying participant information sheet (Appendix 2) included an outline of the purpose and design of the study and procedure for data collection. Subsequent to their written agreement to participate, arrangements for data collection were undertaken by telephone. No participant was employed by the NHS at the time and all fulfilled the following inclusion criteria:

- had experience of assessing adults requiring electronic assistive technology;
- had experience of working with adults with an acquired brain injury;
- could speak English fluently.

As the design was contingent on the participant being able to express themselves verbally very fluently, those who were unable to speak English were excluded from the study

3.8.3 Procedure

3.8.3.1 Data Collection

Participants who agreed to take part were invited to a single session. They were seen in their workplace or their choice of another location for two-and-a-half to four hours depending upon the amount of detail provided during the debriefing interview at the end. Each session took place in a quiet room and was audio-recorded in full to allow transcription of the verbal protocol and interview and their subsequent analysis. Data collection took place over four months. A four-part standardised procedure was undertaken with all participants which is illustrated in Figure 3.4 and explained in detail below.

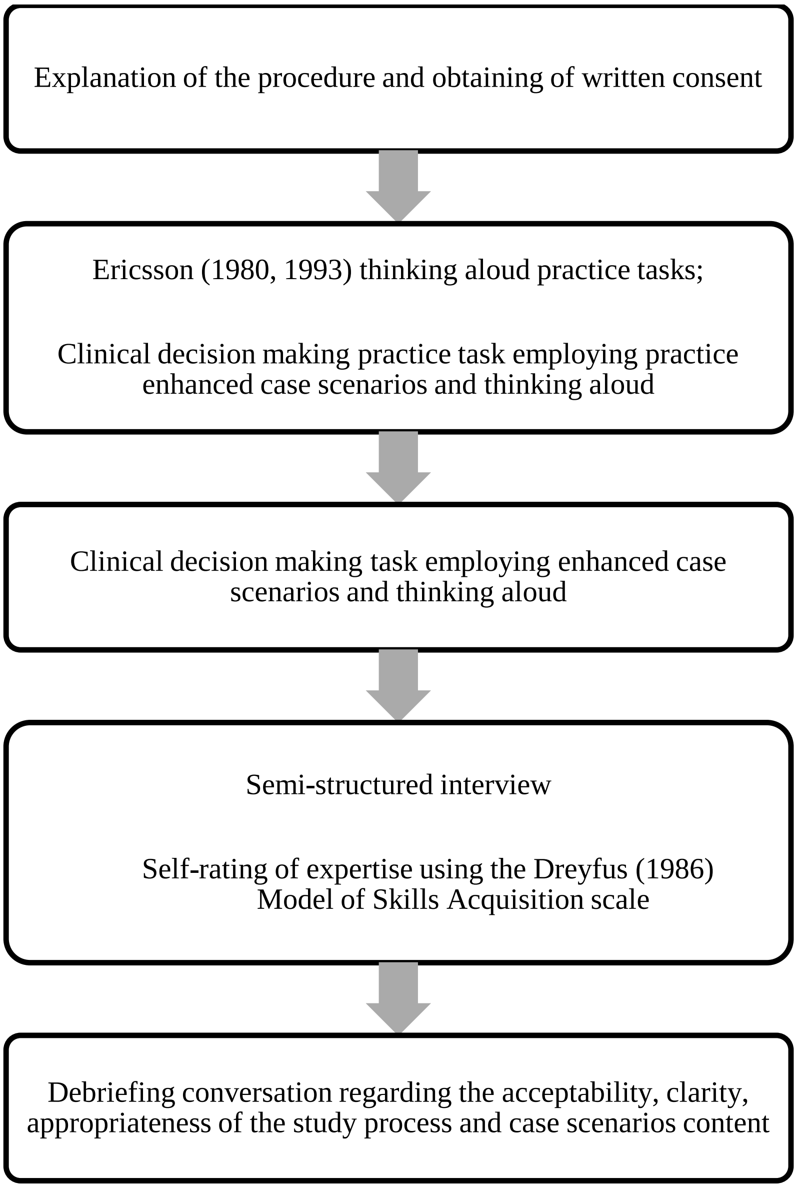

Figure 3.4 The Sequence of Processes Undertaken During Pilot Study Data Collection

3.8.3.2 Explanation and Practice Tasks

The study aims and procedure were explained, any questions were answered and written consent was obtained (Appendix 4).

Three practice tasks were undertaken:

i. two (Ericsson, 1980, 1993) thinking aloud arithmetic practice tasks described in Chapter 2 and detailed in Chapter 6, section 6.3.2 followed by

ii. a brief clinical decision making practice task employing a practice video and audio enhanced case scenario. This task was carried out in the same manner as described for the non-practice task below.

3.8.3.3 Clinical Decision Making Task

Subsequent to successful completion of all practice tasks, each participant was requested to think aloud during a clinical decision making task. The same verbal instruction was given to each participant and is provided in Chapter 6, section 6.3.2. Information for the task was composed of two sources:

Source 1: Each participant was given enough written information to simulate a clinical referral, which included an audio speech sample and simulated video footage. Standardised written case information regarding the individual's need for EAT was also provided (see Chapter 6, Section 6.3.2).

Source 2: In order to standardise responses to participants' potential questions, an expanded version of each case scenario was available to the researcher. Initially, additional information was provided in a written format on cards in order to minimise interaction. However, as a result of the first two pilot participant's feedback, this was subsequently changed to a verbal format to ensure the flow of the think aloud was not disrupted as providing the appropriate card could be time consuming and distracting.

3.8.3.4 Semi-Structured Interview

A semi-structured interview was carried out after completion of the clinical decision making task. Each question (see Chapter 4, section 4.2.4.2) was asked in the same order of all participants. The following definitions of expertise and role were provided prior to each question in order to ensure consistency across all participants.

- **Expertise**: their specialist professional knowledge and skills within electronic assistive technology assessment;

- **Role**: their specific function and contribution during assessment for electronic assistive technology.

Participants were also asked to self-rate their level of expertise within the field of electronic assistive technology according to the Dreyfus Model of Skills Acquisition categorical scale (Dreyfus and Dreyfus, 1986). Descriptors for each of the five parameters were provided .

3.8.3.5 Debriefing Conversation

When data collection was complete each participant was asked to provide feedback on the acceptability, clarity, appropriateness and completeness of the care scenario content. They were also asked for feedback on the procedure (e.g. written vs. spoken instructions), practice tasks and ease or difficulty of staying on task when thinking aloud.

3.8.4 Materials

3.8.4.1 Enhanced Case Scenarios: Written

Three written case scenarios, enhanced with the use of video footage and audio recording were tested during the pilot study.

The written hand-out given to the participant as the clinical problem-solving task provided typical referral information for an adult presenting with a range of difficulties subsequent to an acquired brain injury and preparing for discharge from hospital. Table 3.3 displays the information categories included. Table 3.4 has the practice written case scenario. The two expanded written case scenarios are available in Chapter 6, section 6.4.

Table 3.3 Categories of Information included in the Participants' Written Case Scenarios

Categories of information included in participants' written case scenarios
1. Biographical Details 2. Medical History and Presenting Condition 3. Cultural and Linguistic Background 4. Height and Weight 5. Medications 6. Communication Status 7. Physical Abilities

Table 3.4 Participant's Practice Written Case Scenario

NAME	Jeff
DOB / AGE	3/7/50 – 57
FAMILY BACKGROUND	Jeff lives with his wife in a detached house in the country. He has three adult children who live away from home. In addition he also as 3 primary school-age grandchildren who visit regularly. His wife does not work.
CULTURAL AND LINGUISTIC BACKGROUND	He is originally from Scotland and his extended family still live there. His first language is English and he can also speak Italian and French.
MEDICAL HISTORY	Mild hypertension Stomach ulcer
CURRENT MEDICAL HISTORY	1. Acquired brain injury (27th September 2006) – had a high speed crash while driving a Formula One car during an "experience" day. 2. Epilepsy – tonic-clonic seizures Was an inpatient in an acute hospital trust from September to beginning of March 2007. Transferred to an independent brain injury rehab unit on 4 March 2007. Due to be discharged home within the next four weeks.
HEIGHT AND WEIGHT	Height: 1.85 m / 6.1 ft Weight: 74 kg / 11.6 stone
MEDICATIONS	Phenytoin Perindopril Fibrogel Lansoprazole
COMMUNICATION	Jeff presents with mild receptive aphasia which affects his ability to understand complex conversation. He has severe apraxia of speech which severely limits his ability to speak and apart from a few set phrases he has no useful speech. His reading and writing has also been affected. He can spell the first few letters of many common words and is beginning to read short paragraphs of text.
PHYSICAL ABILITIES	He presents with bilateral increased extensor tone in his lower limbs with fluctuation of tone in his upper limbs. He has weakness and limited functional use of his left arm and hand. He can elevate his right shoulder to 10 degrees through forward flexion, and has 10 degrees active elbow extension although decreased in power. He has a pincer grip in his right hand.

The expanded version of each case scenario, for the use of the researcher included comprehensive background detail such as the results of assessments and outcome measures. The additional categories of information are outlined in Table 3.5 and the expanded version of the practice written case scenario is presented in Table 3.6.

Table 3.5: Additional Categories of Information included in the Researcher's Written Case Scenarios

Additional Categories of Information included in the Researcher's Written Case Scenarios
1. Assessment Results and Outcome Measurement Scores 2. Behavioural and Emotional Status 3. Cognitive Abilities 4. Employment or Education Status 5. Financial Status 6. Home Situation 7. Languages Spoken 8. Medication Side-effects 9. Personal Activities of Daily Living 10. Seating and Transfers 11. Sensory Abilities 12. Social Interests 13. Therapeutic Input 14. Use of Technology

Table 3.6: Researcher's Expanded Practice Written Case Scenario

NAME	**Jeff**
BEHAVIOURAL AND EMOTIONAL STATUS	
EMOTIONAL STATUS	Jeff is constantly frustrated. He has low frustration tolerance with angry outbursts and is very demanding of his wife and family. This is new behaviour and his wife attributes it to changes in his personality post ABI.
COGNITIVE ABILITIES	
COGNITIVE ABILITIES	Jeff displays periods of impulsivity and is not always realistic about his abilities. He finds it difficult to adapt to new situations.
EMPLOYMENT OR EDUCATION	
EMPLOYMENT / EDUCATION STATUS	Chief Executive large accountancy firm
FINANCIAL STATUS	
FINANCIAL SITUATION	Jeff was the CEO of a large firm for 15 years and earned a sizeable salary. His occupational pension, which he has been able to claim early due to ill health, is excellent. He also had a comprehensive medical insurance which has given him a large lump sum. He is therefore financially stable. He is not claiming any statutory benefits.
HOME SITUATION	
HOME SITUATION	Jeff will be going back home after discharge and is in the process of seeking to employ a carer to live with him and his wife on site. He is keen not to become isolated.
LANGUAGES SPOKEN	
LANGUAGES SPOKEN	Uses foreign languages for leisure, not for business purposes.
MEDICATION SIDE-EFFECTS	
MEDICATION SIDE-EFFECTS	There are no side effects from the medications.
PERSONAL ACTIVITIES OF DAILY LIVING	
PERSONAL ACTIVITIES OF DAILY LIVING	Jeff needs full assistance with all PADL.
TOILETING	Jeff is incontinent of urine and wears a catheter with a leg bag.
FEEDING	Jeff is able to eat a modified oral diet and requires assistance to eat. He would like to become more independent in feeding.

SEATING AND TRANSFERS	
SEATING	Jeff has been prescribed a tilt in space wheelchair with a high-level pressure relief cushion and lateral trunk supports. He has some sitting balance but he needs to be strapped in as he is able to initiate extensor spasms and slide out of the chair.
TRANSFER	He is hoisted for all transfers.
SENSORY ABILITIES	
PERCEPTUAL SYMPTOMS	NAD
SENSORY ABILITIES	Hearing intact Vision intact Loss of sensation throughout left side.
SOCIAL INTERESTS	
LEISURE INTERESTS	Travelling, theatre, polo, reading, extreme sports
THERAPEUTIC INPUT	
THERAPY TEAM	He will be seen by a private multi-disciplinary team established by his Case Manager on discharge. This will include OT, SLT, Physiotherapist and Neuro-Psychologist.
USE OF TECHNOLOGY	
CURRENT TECHNOLOGY USAGE	Has been trialling a Cameleon 4 EC and Communication Unit for the past three months using switch access via a click switch. Finds it too bulky and obvious and not as portable as he would like. Not convinced that he likes the switch. Uses a mixture of symbol and text; click switch access; row-column scanning and slow scan.
PERSONAL REQUESTS FOR ELECTRONIC ASSISTIVE TECHNOLOGY	Would like to be able to communicate in and out of the home using a lightweight, portable system. Also wants same system to be able to send and receive email.
PREVIOUS TECHNOLOGY USE	Jeff was familiar with using the PC for internet and email.

ASSESSMENT RESULTS AND OUTCOME MEASUREMENT SCORES

1. BECK DEPRESSION INVENTORY

1. 0 I do not feel sad.
   1 I feel sad
   2 I am sad all the time and I can't snap out of it.
   3 I am so sad and unhappy that I can't stand it.

2. 0 I am not particularly discouraged about the future.
   1 I feel discouraged about the future.
   2 I feel I have nothing to look forward to.
   3 I feel the future is hopeless and that things cannot improve.

3. 0 I do not feel like a failure.
   1 I feel I have failed more than the average person.
   2 As I look back on my life, all I can see is a lot of failures.
   3 I feel I am a complete failure as a person.

4. 0 I get as much satisfaction out of things as I used to.
   1 I don't enjoy things the way I used to.
   2 I don't get real satisfaction out of anything anymore.
   3 I am dissatisfied or bored with everything.

5. 0 I don't feel particularly guilty
   1 I feel guilty a good part of the time.
   2 I feel quite guilty most of the time.
   3 I feel guilty all of the time.

6. 0 I don't feel I am being punished.
   1 I feel I may be punished.
   2 I expect to be punished.
   3 I feel I am being punished.

7 0 I don't feel disappointed in myself.
1 I am disappointed in myself.
2 I am disgusted with myself.
3 I hate myself.

8. 0 I don't feel I am any worse than anybody else.
1 I am critical of myself for my weaknesses or mistakes.
2 I blame myself all the time for my faults.
3 I blame myself for everything bad that happens.

9. 0 I don't have any thoughts of killing myself.
1 I have thoughts of killing myself, but I would not carry them out.
2 I would like to kill myself.
3 I would kill myself if I had the chance.

10. 0 I don't cry any more than usual.
1 I cry more now than I used to.
2 I cry all the time now.
3 I used to be able to cry, but now I can't cry even though I want to.

11. 0 I am no more irritated by things than I ever was.
1 I am slightly more irritated now than usual.
2 I am quite annoyed or irritated a good deal of the time.
3 I feel irritated all the time.

12. 0 I have not lost interest in other people.
1 I am less interested in other people than I used to be.
2 I have lost most of my interest in other people.
3 I have lost all of my interest in other people.

13. 0 I make decisions about as well as I ever could.
1 I put off making decisions more than I used to.
2 I have greater difficulty in making decisions more than I used to.
3 I can't make decisions at all anymore.

14. 0 I don't feel that I look any worse than I used to.
1 I am worried that I am looking old or unattractive.
2 I feel that there are permanent changes in my appearance that make me look unattractive.
3 I believe that I look ugly.

15. 0 I can work about as well as before.
1 It takes an extra effort to get started at doing something.
2 I have to push myself very hard to do anything.
3 I can't do any work at all.

16. 0 I can sleep as well as usual.
1 I don't sleep as well as I used to.
2 I wake up 1-2 hours earlier than usual and find it hard to get back to sleep.
3 I wake up several hours earlier than I used to and cannot get back to sleep.

17. 0 I don't get more tired than usual.
1 I get tired more easily than I used to.
2 I get tired from doing almost anything.
3 I am too tired to do anything.

18. 0 My appetite is no worse than usual.
1 My appetite is not as good as it used to be.
2 My appetite is much worse now.
3 I have no appetite at all anymore.

19. 0 I haven't lost much weight, if any, lately.
1 I have lost more than five pounds.
2 I have lost more than ten pounds.
3 I have lost more than fifteen pounds.

20. 0 I am no more worried about my health than usual.
1 I am worried about physical problems such as aches and pains, or upset stomach, or constipation.
2 I am very worried about physical problems and it's hard to think of much else.
3 I am so worried about my physical problems that I cannot think about anything else.

21. 0 I have not noticed any recent change in my interest in sex.
1 I am less interested in sex than I used to be.
2 I have almost no interest in sex.
3 I have lost interest in sex completely.

Total Score 18

Levels of Depression

1-10 ____________________ These ups and downs are considered normal
11-16 ____________________ Mild mood disturbance
17-20 ____________________ Borderline clinical depression
21-30 ____________________ Moderate depression
31-40 ____________________ Severe depression
over 40 ____________________ Extreme depression

2. HOSPITAL ANXIETY AND DEPRESSION SCALE (HADS)

I feel tense or wound up

- Most of the time
- A lot of the time
- From time to time
- Not at all

I still enjoy the things I used to enjoy

- Definitely as much
- Not quite so much
- Only a little
- Hardly at all

I get a sort of frightened feeling as if something awful is about to happen

- Very definitely and quite badly
- Yes, but not too badly
- A little, but it doesn't worry me
- Not at all

I can laugh and see the funny side of things

- As much as I always could
- Not quite as much now
- Defiantly not so much now
- Not at all

Worrying thoughts go through my mind

- A great deal of the time
- A lot of the time
- From time to time but not too often
- Only occasionally

I feel cheerful

- Not at all
- Not often
- Sometimes
- Most of the time

I can sit at ease and feel relaxed

- Definitely
- Usually
- Not often
- Not at all

I feel as if I am slowed down

- Nearly all the time
- Very often
- Sometimes
- Not at all

I get a sort of frightened feeling like butterflies in the stomach

- Not at all
- Occasionally
- Quite often
- Very often

I have lost interest in my appearance

- Definitely
- I don't take as much care as I should
- I may not take quite as much care
- I take just as much care as ever

I feel restless as if I have to be on the move

- Very much indeed
- Quite a lot
- Not very much
- Not at all

I look forward with enjoyment to things

- As much as I ever did
- Rather less than I used to
- Definitely less than I used to
- Hardly at all

I get sudden feelings of panic

- Very often indeed
- Quite often
- Not very often
- Not at all

I can enjoy a good book or radio or TV programme

- Often
- Sometimes
- Not often
- Very seldom

3. FIM / FAM SCORES

SELF CARE ITEMS	SCORE
Feeding	1
Grooming	1
Bathing	1
Dressing Upper Body	1
Dressing Lower Body	1
Toileting	1
Swallowing	6
SPHINCTER CONTROL	
Bladder Management	6
Bowel Management	6
MOBILITY ITEMS (Type of Transfer)	
Bed/Chair/Wheelchair	1
Toilet	1
Shower	1
Car Transfer	1
LOCOMOTION	
Walking/Wheelchair	1
Stairs	1
Community Access	1
COMMUNICATION ITEMS	
Comprehension-Audio/Visual	6
Expression-Verbal, Non-Verbal	1
Reading	6
Writing	1
Speech Intelligibility	1
PSYCHOSOCIAL ADJUSTMENT	
Social Interaction	5
Emotional Status	4
Adjustment to Limitations	4
Employability	1
COGNITIVE FUNCTION	
Problem Solving	6
Memory	6
Orientation	6
Attention	6
Safety Judgment	5

Scale:

7 Complete Independence (timely, safely)

6 Modified Independence (extra time, devices)

5 Supervision (cuing, coaxing, prompting)

4 Minimal Assist (performs 75% or more of task)

3 Moderate Assist (performs 50%-74% of task)

2 Maximal Assist (performs 25% to 49% of task)

1 Total Assist (performs less than 25% of task)

4. MOTOR ASSESSMENT SCALE

MOVEMENT SCORING SHEET

MOVEMENT	0	1	2	3	4	5	6
SUPINE TO SIDE LYING	X						
SUPINE TO SITTING OVER SIDE OF BED	X						
BALANCED SITTING	X						
SITTING TO STANDING	X						
WALKING	X						
UPPER ARM FUNCTION		X					
HAND MOVEMENTS		X					
ADVANCED HAND ACTIVITIES	X						

5. THERAPY OUTCOME MEASURES for APHASIA

IMPAIRMENT SCALE

0 Severe aphasia affecting all modalities: auditory and reading comprehension inconsistent even at one key word. No meaningful expression.

1 Severe aphasia: auditory and / or reading comprehension is consistent at one key word level. Occasionally understands and expresses limited amount.

2 Severe / Moderate aphasia: auditory and / or reading comprehension is consistent at a minimum of two to three key word level. Some limited verbal / and or written expression used appropriately and purposefully.

3 Moderate aphasia: Constant auditory and / or reading comprehension for simple sentences and structures. Inconsistent with complex commands and structures. Consistently reduced verbal and /or written language structure and vocabulary. May have a specific more severe difficulty in one modality.

4 Mild aphasia: occasional difficulties present in auditory and / or reading comprehension and in verbal and / or written expression.

5 No aphasia.

ACTIVITY SCALE

0 Unable to communicate in any way. No effective communication. No interaction

1 Occasionally able to make basic needs known with familiar or trained persons or trained listeners in familiar contexts. Minimal communication with maximal assistance.

2 Limited functional communication. Consistently able to make basic needs / conversation understood but is heavily dependent upon cues and context. Communicates betters with trained listener or family members

or in familiar settings. Frequent repetition required. Maintains meaningful interaction related to here and now.

3 Consistently able to make needs known but can sometimes convey more information than this. Some inconsistency in unfamiliar settings. Is less dependent for intelligibility on cues and context. Occasional repetition required. Communicates beyond here / now with familiar persons, needs some cues and prompting.

4 Can be understood most of the time by any listener despite communication irregularities. Holds conversation, requires some special consideration, particularly with a wider range of people.

5 Communicates effectively in all situations.

PARTICIPATION SCALE

0 Unable to fulfil and social/educational/family role. Not involved in decision making / no autonomy / no control over environment. No social integration.

1 Low self-confidence / poor self-esteem/ upset/frustration/anger/distress/ embarrassment/concern/withdrawal teem/limited social integration/socially isolated/contributes to some basic and limited decisions. Cannot achieve potential in any situation.

2 Some self-confidence/some social integration/makes some decisions and influences control in familiar situations.

3 Some self-confidence, autonomy emerging. Makes decisions and has control of some aspects of life. Able to achieve some limited social integration/educational activities. Diffident over control over life. Needs encouragement to achieve potential.

4 Mostly confident, occasional difficulties integrating or in fulfilling social/role activity. Participating in all appropriate decisions. May have difficulty in achieving potential in some situations occasionally.

WELLBEING / DISTRESS SCALE

0	Severe constant: upset/frustration/anger/distress/ embarrassment/concern/withdrawal
1	Frequently severe: upset/frustration/anger/distress/ embarrassment/concern/withdrawal
2	Moderately consistent : upset/frustration/anger/distress/ embarrassment/concern/withdrawal
3	Moderate frequent: upset/frustration/anger/distress/ embarrassment/concern/withdrawal
4	Mild occasional: upset/frustration/anger/distress/ embarrassment/concern/withdrawal
5	No inappropriate: upset/frustration/anger/distress/ embarrassment/concern/withdrawal

6. RIVERMEAD PERCEPTUAL ASSESSMENT BATTERY

CLASSIFICATION of TASKS	TASK	MAXIMUM SCORE	SCORE	TIME LIMIT	TIME
Form Constancy	Picture Matching	4	4	3	3
	Object Matching	4	4	3	3
	Size Recognition	4	4	3	3
Colour Constancy	Colour Matching	12	12	3	3
Sequencing	Series	4	4	3	3
	Sequencing – Pictures	4	4	3	3
Object Completion	Animal Halves	4	4	3	3
	Missing Article	4	4	3	3
Figure Ground Discrimination	Figure Ground Discrimination	4	3	3	3
Body Image	Body Image	6	5	3	3
	Body Image	6	5	3	3
	Body Image Total	12	10	6	6
	Body Image - SI	8			
Inattention	R/L Copying Shapes L	36	N/A		
	R/L Copying Shapes R	36	2		
	R/L Copying Shapes Total	72	2	5	5
	R/L Copying Words L	16	N/A		
	R/L Copying Shapes R	16	2		
	R/L Copying Shapes - Total	32	2	5	5
	Cancellation		N/A		
Spatial Awarenesss	3D Copying Selection	12	N/A		
	3D Copying Orientation	12	N/A		
	3D Copying – Total	24	N/A	3	
	Cube Copying S	9	N/A		
	Cube Copying O	9	N/A		
	Cube Copying S	9	N/A		
	Cube Copying O	9	N/A		
	Cube Copying S	9	N/A		
	Cube Copying O	9	N/A		
	Cube Copying S	9	N/A		
	Cube Copying O	9	N/A		
	Cube Copying - Total	72	N/A		

3.8.4.2 Enhanced Case Scenario: Video-Footage

The footage per scenario contains approximately two minutes of a simulated patient filmed in a wheelchair for all case scenarios and on a treatment plinth for one case scenario in order to demonstrate physical abilities. Table 3.7 outlines the recorded content is available in Appendix 1 (DVD).

Table 3.7: Content of the Case Scenario Video-Footage

Movements Contained within the Case Scenarios Video -Footage
1. Habitual position at rest 2. Sitting balance 3. Head control 4. Trunk control 5. Upper limb function 6. Hand function 7. Lower limb function 8. Foot control

3.8.4.3 Enhanced Case Scenario: Audio-Clips

The audio speech samples consist of anonynomised 30 second clips of sentences spoken by adults who have had an acquired brain injury and either dysarthria or apraxia and they have given their consent for use in the study.

Each speech sample contains different content and the recording is representative of how each case scenario individual may sound in conversation, based upon their communication disorder.

3.8.4.4 Semi-Structured Interview

Three open-ended questions exploring the specialist knowledge and role of participants were developed. The interview schedule is available in Chapter 4, Section 4.2.4.2.

The Dreyfus Model of Skills Acquisition categorical scale (Dreyfus and Dreyfus, 1986) with descriptors for each of the five parameters were provided (see Chapter 4, Table 4.1).

3.8.5 Data Analysis

3.8.5.1 Transcription and Segmentation of Verbal Protocols

One verbal protocol per participant (*n*=7) was analysed (*n*=7). The verbal data was transcribed verbatim by the researcher adhering to the Jefferson Lite Transcription style (Jefferson, 2004) for the verbal protocols. Each verbal protocol was read straight through twice in order to gain an overall perspective of the content prior to segmentation.

3.8.5.2 Coding of Verbal Protocols

The verbal protocols were analysed in four different ways to investigate the process and content of decision making. Figure 4.3 illustrates the coding procedure demonstrating the four forms of coding analysis.

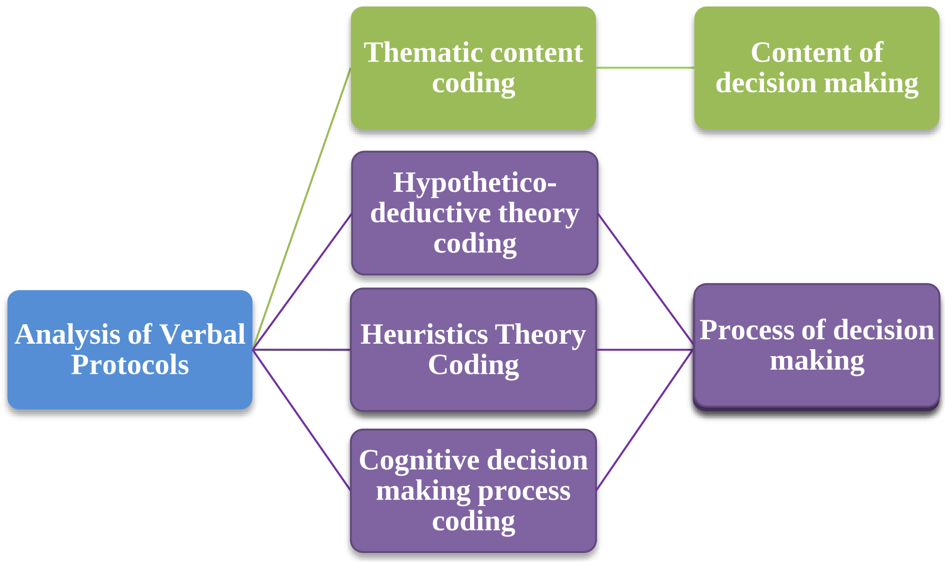

Figure 3.5: Overview of Coding Procedure for Analysis of the Verbal Protocols

a) Content of Decision Making Coding

Preliminary descriptive thematic coding was employed for one verbal protocol per participant (*n*=7).

b) Process of Decision Making Coding

Three forms of analysis were carried out. Two are based on established models in order to examine these models of decision making against present findings, and the third, a cognitive processes analysis, to examine decision making processes within the
present findings.

i. Hypothetico-Deductive Theory Coding

One verbal protocol per participant (*n*=7) was coded according to the four stages of decision making proposed within the Hypothetico-deductive model (Elstein et al., 1978). The definition of the codes used within this study were based upon Elstein's and are provided in 3.7

Table 3.8 The Hypothetico-Deductive Codes and their Definition as used within the Pilot Study

Hypothetico-Deductive Codes	Definition
Cue Acquisition	Gathering preliminary information. May involve personal or clinical interpretation of visual and auditory findings. Includes all questions.
Hypothesis generation	Generate initial hypothesis for preliminary information then following this, the clinician generates initial and tentative hypotheses (usually around 4-6 in number). These are related to data already gathered.
Cue interpretation	Interpretation of cues gathered and classifying them as confirming, refuting or not contributing to the initial hypothesis.
Hypotheses evaluation	Determining an explanation. In the final stage the clinician weighs up the pros and cons of each decision alternative and chooses the one most favoured by the evidence.

ii. **Heuristics Theory Coding**

One verbal protocol per participant (*n*=7) was coded according to Heuristics Theory (Kahneman et al., 1982). The data was coded in relation to three commonly used heuristics within decision making, Anchoring and Adjustment, Availability and Representativeness (Tversky and Kahneman, 1974). The definition of the codes used within this study were based upon (Tversky and Kahneman, 1974) and are provided in Table 3.9

Table 3.9 The Heuristic Codes and their Definition as used within the Pilot Study

Heuristic codes	Definition
Availability (frequency)	Characterised by the ease with which instances of similar conditions come to mind. It is likely to be the heuristic process employed when events are thought of more readily in terms of particular cases.
Representativeness (likelihood)	Judging the probability that certain signs and symptoms indicate a particular condition that the participant has previously encountered.
Anchoring and adjustment (prediction)	When making a judgement, the participant starts from an initial estimate (anchor point or baseline) and then adjusts away from this anchor point to take account of individual characteristics and arrive at a final estimate.

iii. **Cognitive Decision Making Process Coding**

In order to examine in-depth the decision making processes employed by these participants, codes based on those identified in the literature were employed. (see section 3.7.5.2 a) for further details)

3.8.5.3 Specialist Knowledge and Role

The interview scripts were not thematically analysed but their content was used to clarify the wording, check for face validity and consistency of administration of the interview questions and the descriptors generated for the Dreyfus Model of Skills Acquisition levels.

3.8.6 Results

3.8.6.1 Content of Decision Making Coding

Thirty-two codes were derived from the descriptive thematic coding of the verbal protocols. No further analysis was undertaken as this was sufficient to show face and content validity and therefore the potential to answer the research questions satisfactorily.

3.8.6.2 Process of Decision Making Coding

i. **Hypothetico-Deductive Theory Coding**

Seventy-one percent (*n*=5; BE, n=1, 100%; OT, n=2, 50%; SLT, n=2, 100%) of participants utilised the four stages of Elstein's model throughout their verbal protocols and 100% employed three. Hypothesis Evaluation was excluded by two OTs. This shows a fit between a medical decision making model and the pilot data and therefore the research question can be answered.

ii. **Heuristics Theory Coding**

Fifty-seven percent (*n*=4) of the participants utilised heuristics (BE, *n*=0; OT, *n*=3, 75%; SLT, *n*=1, 50%). Anchoring and Adjustment was employed by three participants (BE, *n*=0; OT, *n*=2, 50%; SLT, *n*=1, 50%) and Availability and Representativeness by two respectively (*n*=2; OT, 50%). This shows enough of a fit that the data collection will be able to answer the research question.

iii. **Cognitive Decision Making Process Coding**

In order to examine the decision making processes employed by these participants, codes based on those identified in the literature were employed as noted in Section 3.7.4.2b. The codes were applied by the researcher and two blind researchers and adjustments were made to the definitions to accommodate unforeseen instances. This resulted in an additional four codes. Some definitions were tightened to avoid ambiguities. All codes were used at least once and no segments were left uncoded. The final codes and their definitions are shown in Table 3.10 presented in alphabetical order.

Table 3.10 The Final Cognitive Decision Making Process Codes and their Definition

Cognitive Decision Making Process Code	Definition
Collect	To acquire information from the enhanced case scenario and by asking for further details.
Deduce	To extrapolate meaning from the information based on practitioner's perspective.
Discard	Irrelevant explanation, personal commentary or opinion which does not contribute to the decision- making process.
Formulate	To propose a course of action or intervention.
Interpret	To demonstrate an understanding of the information consistent with professional knowledge.
Judge	To make a judgment regarding the relevance, importance or value of the information.
Predict	To propose how the client may be in the future from a biopsychosocial perspective.
Prescribe	To recommend a specific assistive technology solution.
Reason	To provide a rationale for a course of action or recommendation.
Reflect	To indicate the process of thinking and demonstrate a metacognitive awareness of their own thought processes.
Restate	To summarise their own thinking by repeating previously acquired or considered information.
Review	To re-appraise the recommended future course of action.

3.8.6.3 Specialist Knowledge and Role

The interview scripts were not thematically analysed but their content was used to evaluate and successively amend the wording (following each testing session) of the interview questions and the descriptors generated for the Dreyfus Model of Skills Acquisition levels until no more changes were needed. Final wordings are shown in Chapter 4, Section 4.2.4.2.

3.8.7 Amendments and Refinements of Procedure and Materials

Throughout the pilot study amendments and refinements were made incrementally to both the procedure and the materials following each session with a participant until no more changes were needed.

The procedural refinements were:

- physical arrangement of the researcher and participant within the room in order to prevent engagement in conversation, settling in and sitting at 90° from each other;
- improved accuracy and clarity of instructions for thinking-aloud as given in Appendix 4;
- modification of the researcher's vocabulary during the "thinking-aloud" phase. Vocabulary used by the researcher during the first two pilot sessions negatively impacted upon the validity of the verbal data. The participants were asked "what are you thinking" which resulted in explanation, a Type 3 verbalisation rather thinking-aloud. The prompt was changed to: "keep thinking aloud" and it evoked the correct response from then on;
- the method of providing additional information upon request from written cards to verbal pre-worded sentences without compromising the flow of thinking aloud or the ecological validity.

Amendments to the materials were:

- inclusion of a practice case scenario in addition to the Ericsson and Simon (1993) think-aloud practice tasks after the first session;

- minor additions to the written content of the expanded researcher's case scenarios based upon participants' questions.

The pilot study was considered complete when no further changes were required to the materials, procedure or methodology for the last three participants.

3.8.8 Conclusions

The pilot study confirmed that the methodological design, materials and methods of analysis were suitable to answer the research questions. Specifically, it identified that :

- the content and face validity of the participant and researcher enhanced case scenarios were comprehensive and ecologically valid;
- the interview questions were clearly worded and had face and content validity;
- the wording when instructing the participants' to think aloud produced the desired outcome;
- generation of verbal protocols utilising concurrent thinking-aloud enabled preliminary analysis of decision making in accordance to known models;
- the literature-based process codes were suitable for use, with minor adaptations, for the data derived. Further testing would be required by the main study.

Chapter 4

Methodology Study 1: Investigation of Specialist Knowledge and Role in Assessment for EAT

4.1 Introduction

This chapter presents the methodology for Study 1 which investigates the participants' self-perception of their specialist knowledge and role within the assessment for EAT.

4.2 Method

4.2.1 Design: Survey

A survey study, using semi-structured interviews to investigate the participants' perception of their specialist knowledge and role during the assessment for electronic assistive technology.

4.2.2 Participants

4.2.2.1 Sample and Inclusion Criteria

A purposive sample of 61 professionals was recruited from assistive technology centres and brain injury units across England. The participants were biomedical engineers, occupational therapists and speech and language therapists. Inclusion criteria:

- experience of assessing adults requiring electronic assistive technology;
- experience of working with adults with an acquired brain injury;
- speak English fluently.

Those who were unable to speak English fluently were excluded from the study as the design was contingent on the participant being able to express themselves verbally well.

4.2.2.2 Recruitment Procedure

Invitations to participate were sent directly to AT services and brain injury units specialising in acute and post-acute rehabilitation within England and were also distributed via an assistive technology email listserv.

All English Assistive Technology centres and Augmentative and Alternative Communication (AAC) Services, excluding those whose service provision was solely for paediatrics were invited. Thirteen out of 14 NHS services agreed to participate; one was unable due to difficulties with staffing capacity. The two charity sector AT centres also participated. Two out of eight NHS brain injury units and two out nine private and not-for-profit sector brain injury units participated. Those unable to participate declined due to staffing capacity.

Letters of invitation (Appendix 5) were sent to the head of the each service and were subsequently distributed to each team. The invitation was accompanied by a Participant Information Sheet, (Appendix 3) incorporating a Participant Response Form which each participant was required to return via email or mail to indicate their interest in taking part. Subsequent to receipt of the participant response form contact was made directly with the potential participants and a date for data collection was agreed.

4.2.2.3 Work Settings of the Participants

The participants worked in either an AT Service or a Brain Injury Unit. All BE participants (*n*=20, 100%), 95% (*n*=19) of OTs and 95% (*n*=19) of SLTs worked in the same geographical location as at least one other profession involved in assessment for AT.

i. **Assistive Technology Services**

   The method of service provision and professional composition of AT services differs across England. They may be comprised of any of the following:

- an assistive technology centre where all professionals are located on the same site and within the same department;
- a hospital medical physics department working in collaboration with a communication aid service in a different location;
- a disability technology service comprising BEs and OTs working in collaboration with a communication aid service in a different location

A key feature of working within an assistive technology centre is regular formal and informal collaboration with other professional disciplines. Collaboration is also a feature of services which do not share the same geographical location.

ii. **Brain Injury Units**

Brain injury units assess and provide for adults with an acquired brain injury. The units range from those providing acute and post-acute medical care to non-acute, rehabilitation-focused services. Individuals are provided with electronic assistive technology where appropriate.

4.2.2.4 Ethical and Research and Development Approval

As participants were recruited from the NHS, an application for ethical approval was submitted to the Hertfordshire Research Ethics Committee of the NHS National Research Ethics Committee (NRES) and favourable ethical approval was gained (Reference No 07/H0311/201). See Appendix 6 for Letter of Approval. The research was designated as exempt from site-specific assessment. Ten Research and Development (R&D) applications were submitted to NHS Trusts and approval was obtained from each (see Appendix 7 for example of approval letter).

4.2.3 Procedure

4.2.3.1 Data Collection

Data collection was carried out in a quiet room at each participant's workplace. The researcher provided an explanation of the research study expanding upon the details provided in the Participant Information Sheet and written consent was obtained. See Appendix 8 for an anonymised consent form.

The following definitions of expertise and role were provided prior to each question in order to ensure coherence across all participants.

- **Expertise**: their specialist professional knowledge and skills within electronic assistive technology assessment;

- **Role**: their specific function and contribution during assessment for electronic assistive technology.

Each question was asked in the same order for all participants. The interview took on average, 10 minutes. All interviews were audio recorded using a Philips Voicetracer 7675 digital voice recorder.

4.2.4 Materials

4.2.4.1 Self-Rated Level of Expertise Rating Scale

Participants were asked to self-rate their level of expertise within the field of electronic assistive technology using the Dreyfus Model of Skills Acquisition, a five-point scale developed to quantify skill acquisition and expertise (Dreyfus and Dreyfus, 1986). Descriptors for each of the five parameters were provided (Table 4.1) and each participant identified their level of expertise.

Table 4.1: Definitions Provided for the Dreyfus Model of Skills Acquisition

Level of Skill Acquisition	Identifying Characteristics
Beginner	i. Able to recognise key attributes or aspects; ii. Has little situational experience; iii. Observes rigid adherence to taught rules or plans; iv. Demonstrates no discretionary judgment.
Advanced Beginner	i. Guidelines for action based on attributes or aspects; ii. Situational perception still limited; iii. All attributes and aspects are treated separately and given equal importance.
Competent	i. Able to cope with "crowdedness" of information; ii. Now sees actions at least partly in terms of longer-term goals; iii. Undertakes conscious deliberate planning; iv. Familiar with standardised and routine procedures.
Proficient	i. Sees situations holistically rather than in terms of aspects; ii. Sees what is most important in a situation; iii. Able to perceive deviations from the normal pattern; iv. Decision making less laboured; v. Uses maxims for guidance, whose meaning varies according to the situation.
Expert	i. No longer relies on rules, guidelines or maxims; ii. Intuitive grasp of situations based on deep tacit understanding; iii. Analytic approaches used only in novel situations or when problems occur; iv. Has a vision of what is possible.

4.2.4.2 Interview Questions

Three open-ended questions exploring the participants' specialist knowledge and role were developed. The questions were:

1. Within electronic assistive technology assessment, what do you consider your particular area of expertise?

2. What specific role do you think the (BE / OT / SLT)* performs within the assessment for electronic assistive technology.

3. In a case you've recently been involved in, can you tell me about your role as a (BE / OT / SLT)* during the assessment process?

* Each participant's profession dictated the form of the question.

4.2.5 Quantitative and Qualitative Data Analysis

4.2.5.1 Shapiro-Wilk Test of Normality

The participant sample was assessed for normality and to ascertain if the participants were drawn from a normally distributed population. Results are shown in Chapter 5, Section 5.2.4.

4.2.5.2 Analysis of Self-Rated Level of Expertise

Descriptive and non-parametric statistics were used to examine the ordinal categorical data derived from the Dreyfus Model of Skills Acquisition categorical scale. Results are shown in Chapter 5 Section 5.3.

4.2.5.3 Transcription of the Interview Transcripts

Each interview was transcribed verbatim by either the researcher or a professional transcriptionist, which resulted in 60 transcripts. Vigilant observance of confidentiality and anonymity was maintained throughout. Subsequent to verbatim transcription, each transcript was checked for transcription accuracy by listening to the recording and reading it simultaneously.

4.2.5.4 Thematic Content Analysis

In order to investigate the content of the interviews, an inductive data-driven coding method was undertaken to generate concepts within the data (Miles and Huberman, 1994, Richards, 2005). This method involves three stages and the figure below illustrates the process of applying different levels of coding to the data, the arrow indicating the process of moving up through and transformation of the data.

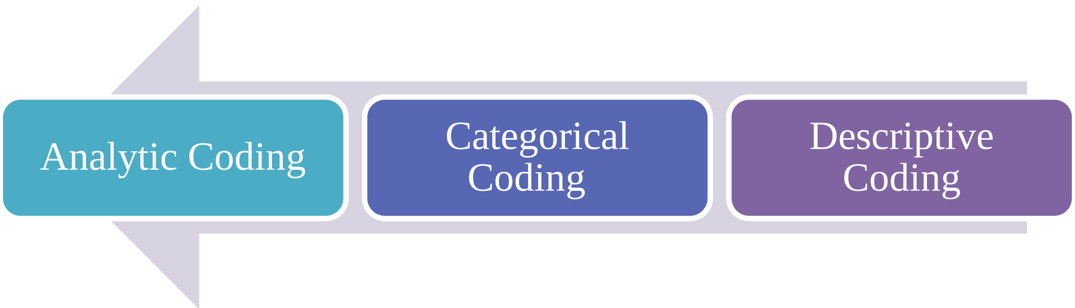

Figure 4.1: The Three Levels of Coding Applied to the Data

i. **Analytic Coding**

This is the highest level of coding applied to the data and enabled **Concepts** to be derived for Expertise and Role, based upon the categorical coding data.

ii. **Categorical Coding**

Categorical coding required making comparisons and judgments of the codes within the descriptive coding in order to generate mutually exclusive **Topics**.

iii. **Descriptive Coding**

All transcripts were imported into NVivo 9 in order to manage the coding process. Each interview transcript was read through prior to commencing coding in order to establish an overall perspective of the content. Next, each interview was read through again and descriptive codes, **Categories**, were derived from the data.

Thirty percent (*n*=18) of the interviews were re-coded by a naïve assessor to ensure reliability of the coding framework. This naïve assessor had a MSc in speech and language therapy with work experience in brain injury and AT provision. The Cohen’s Kappa score k=0.94 for Specialist Knowledge and k=0.95 for Role indicates there was a high level of agreement between the raters.

4.2.6 Chapter Summary

This chapter has laid out the methodology for Study 1 which investigated the participants' specialised knowledge and role in the assessment for EAT. The population sample was described and the procedure and method undertaken was outlined. The interview questions and key characteristics of the Dreyfus Model of Skill Acquisition, used by the participants for self-rating their level of expertise, were presented. The procedure for thematic content analysis was outlined. The next chapter will present the results of this study.

Chapter 5

Results Study 1: Investigation of Specialist Knowledge and Role in Assessment For EAT

5.1 Introduction and Presentation of Findings

The aim of Study 1 was to explore the participants' view of their self-rated level of expertise, specialist knowledge and role within the assessment for EAT and to exemplify their role in clinical practice. Each participant was interviewed and the verbal data was analysed using thematic content analysis. They also self-rated their level of expertise using a five point scale. This chapter commences with a descriptive analysis of the population sample followed by the self-rated level of expertise results. Concepts and topics derived from the thematic content analysis provide insight into the specialist knowledge and role of the professions. The chapter concludes with a summary of the key issues identified in the analysis.

5.2 Population Sample

5.2.1 Response Rate

Thirteen out of 14 NHS services agreed to participate; one was unable due to difficulties with staffing capacity. Two out of two charity sector AT centres also participated. Two out of eight NHS brain injury units and two out of nine private and not-for-profit sector brain injury units participated. The response rate for all professions was over 80%. There was a 100% response rate of BEs with 20 out of a possible 20 taking part. The response rate was 80% for the OTs (20 out of 25 potential OTs) and 88% (21 out of 24 potential SLTs). All were identified as fulfilling the inclusion criteria but in the end some were unable to take part due to issues with staffing capacity. The data collected from one speech and language therapist was not included in analysis due to faulty audio recording, thus the final number was 20. The study was primarily qualitative and with the 60 participants, saturation was achieved. The large sample enabled exploratory statistics to be undertaken, pointing the way for further research.

It is important to note that there was great debate between the researcher, her supervisors and others who were consulted as to what term to use to denote the engineers in this study. These engineers had job titles such as Biomedical Engineer, Clinical Scientist, Clinical Technologist or Rehabilitation Engineer. Additionally the professional qualifications of the engineering participants included Higher National Diplomas (*n*=6), Bachelor's Degree (*n*=5), Master's Degrees (*n*=6), PhDs (*n*=3) and encompassed the fields of biomedical, electrical, mechanical and electronic engineering. It is acknowledged that the heterogeneity and different forms and levels of training, unlike the OTs and SLTs, inherent within this sample has implications for the interpretation of results regarding their process of decision-making and expertise and future studies should be cognisance of such heterogeneity in the methodological design. Whilst the researcher had knowledge of each participant's qualifications the data was not analysed according to education as this heterogeneity in professional titles and qualifications reflects the current clinical practice within EAT service provision within England and clearly has implications for service design and manpower planning. In the end the term Biomedical Engineer was chosen for the purposes of this study because it denoted the role they fulfilled within the AT team and the study of the roles within the MDT was a central part of the study.

Definitions according to the HCPC, the IPEM and NHS for the job titles are in Appendix 16.

5.2.2 Gender

The majority of the participants were female (*n*=39, 65%). The two therapy professions, OT and SLT differed from the BEs in that the majority of participants were female: OTs (*n*=18, 90%) and SLTs (*n*=19, 95%) whereas the majority of BE's were male (*n*=18, 90%).

5.2.3 Work Settings

All BEs (*n*=20,100%), 55% (*n*=11) of OTs and 70% (*n*=14) of SLTs worked in an ATC. Forty-five percent (*n*=9) of OTs and 30% (*n*=6) of SLTs worked in a BIU. All worked within a team structure either on the same site or in a different location.

5.2.4 Experience

The participants' experience of EAT and ABI ranged from 1-29 years. Using the Shapiro-Wilk Test of Normality neither sample was normally distributed (p= 0.036 and p=0.019 respectively). Table 5.1 and Figures 5.1 and 5.2 show the participants' experience of EAT and ABI in years with a superimposed normal distribution curve. Therefore non-parametric statistics were used where appropriate.

Table 5.1: Shapiro-Wilk Test of Normality Results for EAT and ABI Experience

	Shapiro-Wilk Test of Normality		
	Statistic	df	Significance
EAT Experience	0.958	60	0.036
ABI Experience	0.952	60	0.019

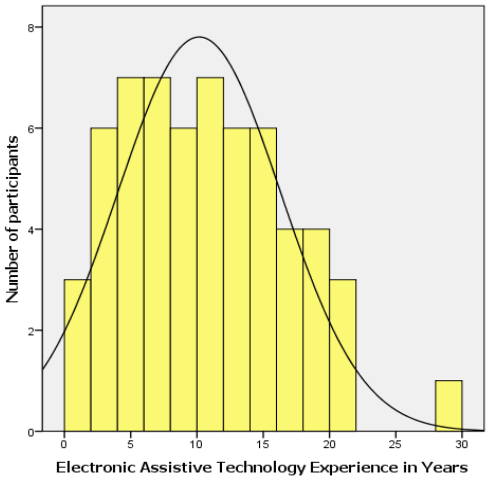

Figure 5.1: Distribution of Participants' EAT Experience in Years

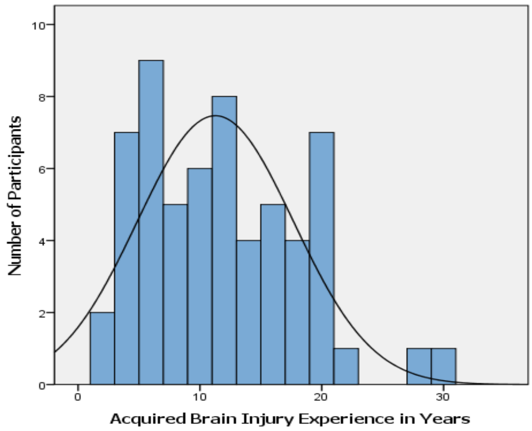

Figure 5.2: Distribution of Participants' ABI Experience in Years

Thirty-three participants (55%) had less than 10 years EAT experience and less than 11 years ABI experience; 27 (45%) participants had greater than 10 and 11 years' experience respectively. Table 5.2 displays the descriptive statistics regarding the experience of all participants. Detailed participant characteristics are available in Appendix 9.

Table 5.2: Participants' Experience in Years

Participant Characteristic	Mean	Standard Deviation	Median	Interquartile range
EAT Experience in Years	10.17	6.14	10	5 - 15
ABI Experience in Years	11.27	6.41	11	6 - 16

5.3 Self-Rated Levels of Expertise

5.3.1 Profession

Participants were asked to self-rate their perceived level of expertise within the field of electronic assistive technology on the Dreyfus Model of Skill Acquisition (Dreyfus and Dreyfus, 1986). Descriptors for each of the five levels were provided and each participant made a judgement regarding their level of expertise. The OTs displayed the greatest spread with participants in all five levels. There was a more flat distribution of SLTs with an equal number in the top three categories. The BEs primarily clustered within the top two categories. Figure 5.3 displays detailed results of the self-rating.

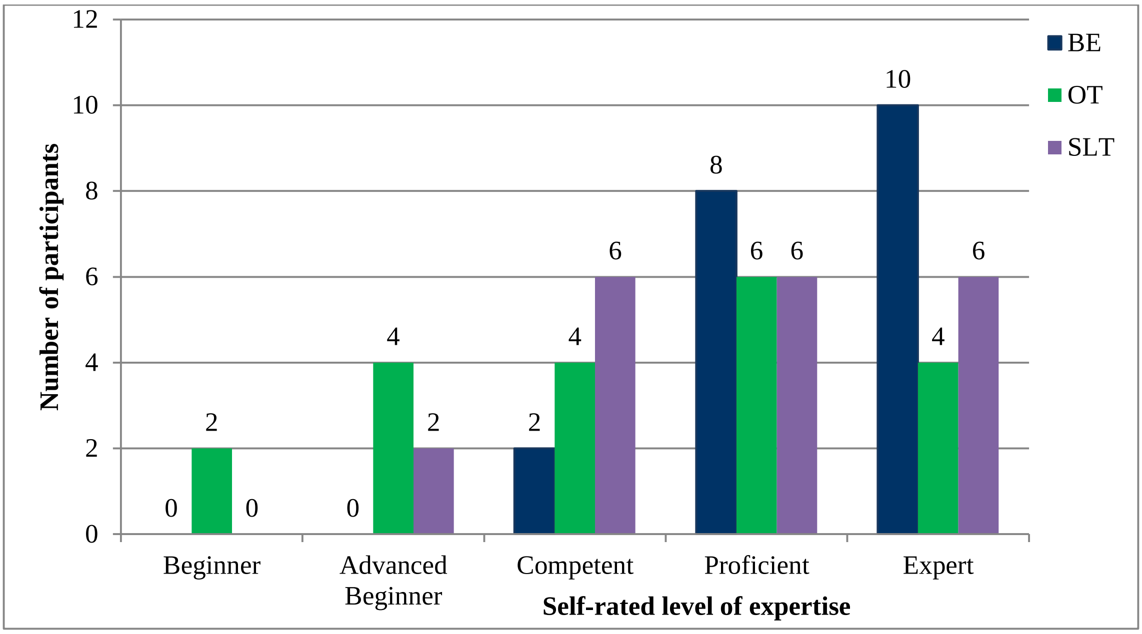

Figure 5.3: Self-Rated Levels of Expertise on the Dreyfus Model of Skill Acquisition

5.3.2 Work Settings

Cross-tabulation of the user's work setting and self-rated level of expertise indicated that the ratings of participants working in a brain injury unit ranged from Beginner to Competent whereas those in assistive technology units were predominately Competent and Proficient. Figure 5.4 displays the contingency table in detail. Doing a nominal by interval association test, eta, the correlation ratio, was 0.719. Eta squared indicated that 51.7% of the variance in the level of expertise was explained by the work setting.

Directional Measures

			Value
Nominal by Interval	Eta	Setting Dependent	.763
		Original Expertise Coding 5 categories Dependent	.719

Figure 5.4 Eta Contingency Table

Table 5.3: Level of Self-Rated Expertise and Work Settings

Setting		Levels of Expertise					Total Participants
		Beginner	Advanced Beginner	Competent	Proficient	Expert	
	ATC	0	1	5	19	20	45
	BIU	2	5	7	1	0	15
	Totals	**2**	**6**	**12**	**20**	**20**	**60**

No BE self-rated themselves as less than Competent and 50% (*n*=10) identified themselves as being Expert. They reported that the intrinsic nature of their job and work setting required a high level of expertise.

5.3.3 Self-Rated Expertise by EAT and ABI Experience

In order to examine if an association existed between the self-rated expertise and years of EAT or ABI experience, an ordinal regression was used. In the case of EAT there was a significant positive association (p=0.003) between experience and expertise while for ABI this was not the case (p=0.227).

5.3.4 Secondary Analysis of Self-Report

The results above show a high proportion of reports towards the more expert levels. Additionally, with a sample of 20 in each profession, for statistical purposes the five categories were collapsed into two. The resultant categories of “Capable” (encompassing Beginner, Advanced Beginner and Competent) and “Accomplished” (encompassing Proficient and Expert) show that 66% (*n*=40) of the sample are “Accomplished” (Figure 5.5).

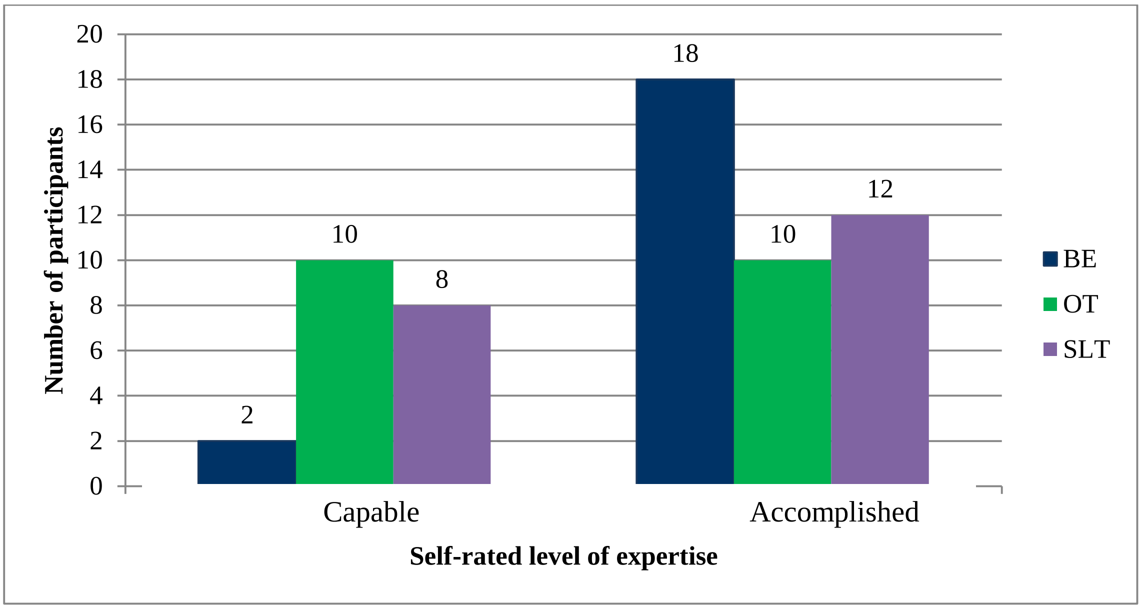

Figure 5.5: Collapsed Categories of the Self-Rated Level of Expertise within Electronic Assistive Technology

5.4 Specialist Knowledge and Role

The interview scripts, derived from the semi-structured interviews were analysed using thematic content analysis to investigate the participant’s specialist knowledge and role during the assessment for EAT. The same four concepts emerged from the data addressing (i) specialist knowledge and (ii) role. The topics, while similar, were not totally identical for each concept. The results are reported by concept, subdivided into topics with specialist knowledge and role results presented in the same section.

Figure 5.6 presents an overview of the concepts and the topics derived from the data. The topics which relate to specialist knowledge and role have been identified in Figure 5.6 as SK and R respectively.

CONCEPTS	TOPICS	
Assessment of ability	**Communication Abilities**	(SK, R)
	Cognitive Abilities	(SK, R)
	Physical Abilities	(SK, R)
Professional Skills	**Technology Familiarity**	(SK, R)
	Holistic Approach	(SK, R)
	Technology Awareness	(SK)
	Professional Knowledge	(R)
Equipment Prescription	**Switch access to technology**	(SK, R)
	Matching people to technology	(SK, R)
	Bespoke Solution	(SK, R)
	Seating & Positioning	(SK, R)
	Environment	(SK, R)
	Risk Assessment	(R)
Implementation of technology	**Functional Usage**	(SK,R)
	Facilitate Independence	(R)

Figure 5.6: Concepts and Topics Derived From the Data Investigating Specialist Knowledge (SK) and Role (R) During the Assessment for EAT

The results are reported in the order presented in Figure 5.6 by Concept and flowcharts provide the detail of the coding at the beginning of each Concept section. The total number of participants reporting each Topic is included as (*n*=) in the flowcharts and at the beginning of each Topic results section. Category data can be identified in the results by the use of (C: *Category name*). Excerpts from the interviews relating to clinical practice are presented as examples in a box at the end of each topic section with the participant's identifying number and profession.

5.4.1 Concept: Assessment of Ability

The concept **assessment of ability** and three topics, **communication abilities, cognitive abilities** and **physical abilities** were derived from the specialist knowledge and role data. For both specialist knowledge and role, 16 categories were identified, which although similar were not identical.

The total number of participants reporting on the concept **assessment of ability** differed substantially by profession (BE, *n*=0; OT, *n*=13, 65%; SLT, *n*=20, 100%). No BE reported either **specialist knowledge** or **role** for this concept. A similar number of OTs and SLTs reported specialist knowledge (OT, *n*=11, 55%; SLT, *n*=10; 50%) in contrast to role (OT, *n*=2, 10%; SLT, *n*=18; 90%).

Figures 5.7 and 5.8 show the coding for each question.

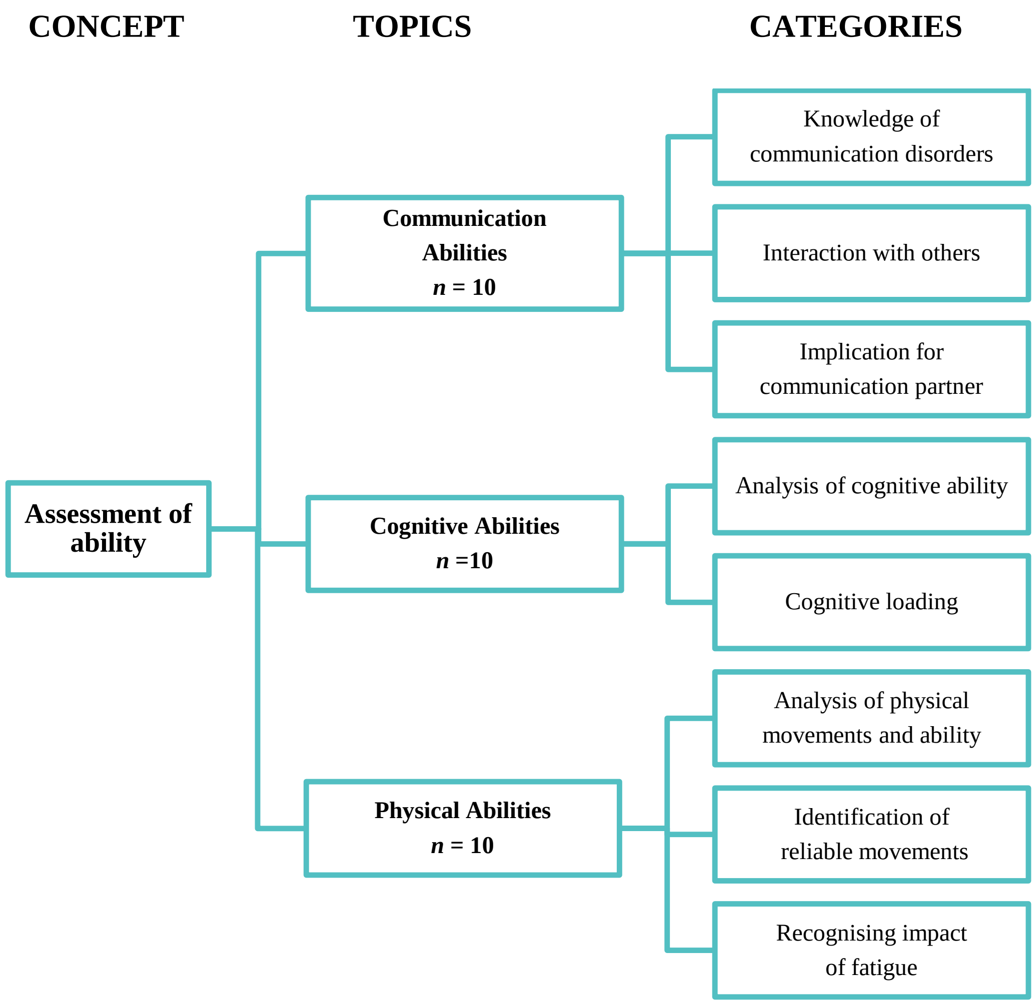

Figure 5.7: Thematic Content Analysis of **Specialist Knowledge** Responses Illustrating the Concept, Topics and Categories Derived from the Data

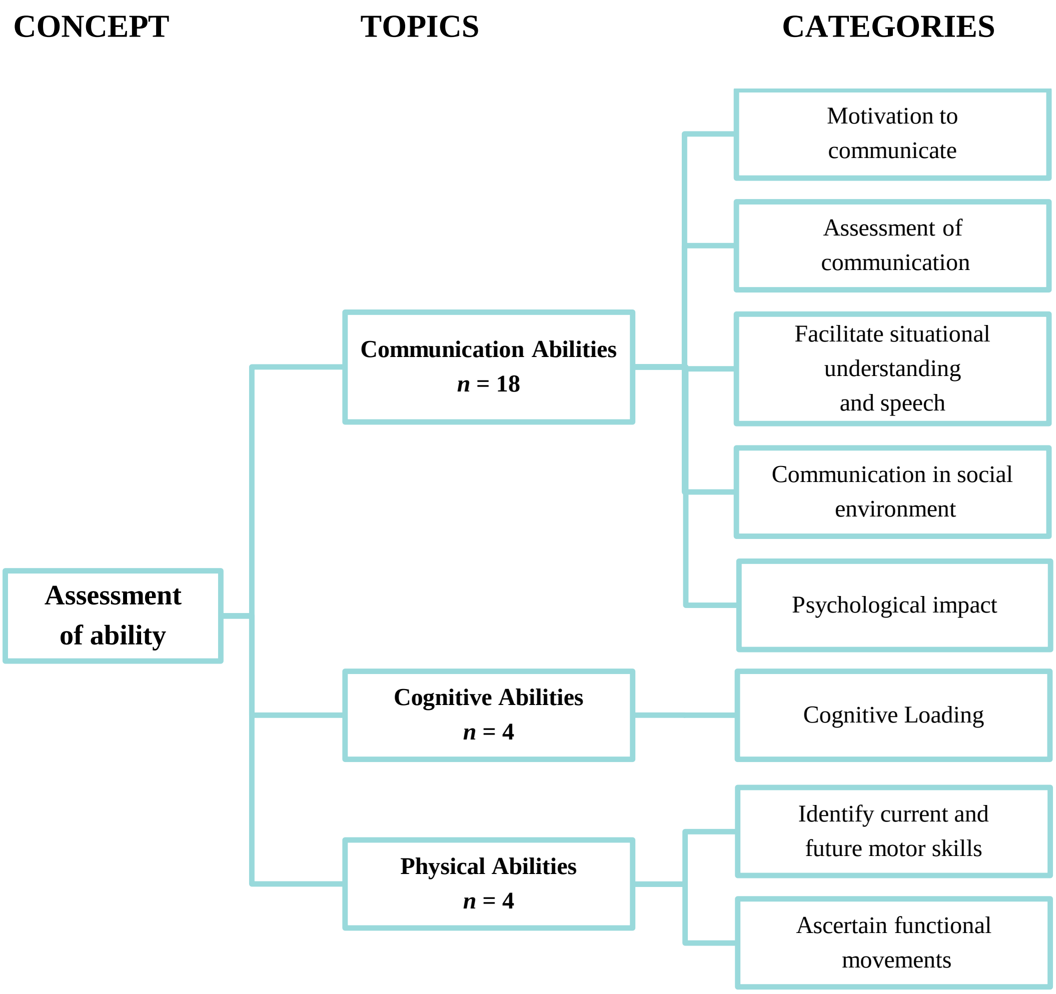

Figure 5.8: Thematic Content Analysis of **Role** Responses Illustrating the Concept, Topics and Categories Derived from the Data

5.4.1.1 Topic: Communication Abilities

COMMUNICATION ABILITIES	
Specialist Knowledge ***n*=10**	**Role** ***n*=18**

The topic **communication abilities** is defined in this study as the functional ability to understand and produce speech, read, write and utilise non-verbal methods to communicate needs, wants and desires. It also incorporates the milieu in which the communication occurs.

Fifty percent of SLTs and no BEs or OTs (BE, *n*=0; OT, *n*=0; SLT, *n*=10; 50%) reported that they had **specialist knowledge** in this area. Four specific areas of specialist knowledge were raised by the SLTs:

i. the assessment of communication, including understanding, speech, reading and writing (*C*: *Knowledge of communication disorders*);
ii. the social use of language and pragmatic skills *(C: Interaction with others*);
iii. support and training of the communication partners *(C*: *Implication for communication partner)*;
iv. appropriate and accessible linguistic layout of the device (*C*: *Knowledge of communication disorders*).

Ninety percent of SLTs and no BEs or OTs (BE, *n*=0; OT, *n*=0; SLT, *n*=18, 90%) stated that it was their **role** within the assessment for EAT. They reported their role included:

i. to ascertain the user's motivation to communicate (*C*: *Motivation to communicate)*;
ii. the assessment of communication, including understanding, speech, reading and writing (*C*: *Assessment of communication*);
iii. advise colleagues on facilitation techniques and strategies *(C*: *Facilitate situational understanding and speech);*
iv. to consider the social environment and to implement low-tech devices where possible *(C*: *Communication in social environment);*

v. be cognisant of the psychological impact of the communication disorder upon the user and their family *(C: Psychological impact).*

Example from clinical practice: "*my role has been starting at the low-tech end and then working up to look at introducing high-tech, alongside the OT*" 25, SLT

5.4.1.2 Topic: Cognitive Abilities

COGNITIVE ABILITIES	
Specialist Knowledge ***n*=10**	**Role** ***n*=4**

The category **cognitive abilities** is defined in this study as executive function skills, which include memory, information processing and the ability to learn.

Thirty-five percent of OTs, 15% of SLTs and no BEs (BE, *n*=0; OT, *n*=7, 35%; SLT, *n*= 3, 15%) reported **specialist knowledge** of cognitive abilities. Ten percent of OTs and SLTs and no BEs stated that it was their **role** (BE, *n*=0; OT, *n*=2, 10%; SLT, *n*= 2, 10%).

Two aspects of **specialist knowledge** were raised by the OTs and SLTs:

i. Knowledge and application of information processing skills was of primary importance particularly when presenting verbal commands and designing the layout of the communication aid (*C*: *Analysis of cognitive ability).*

ii. The level of complexity inherent within the EAT equipment and degree of cognitive loading placed upon the user *(C: Cognitive Loading)*

The OTs stated their **role** involved being aware of and advising the team about cognitive loading and the SLTs reported that they would advise the team on language ability, use of symbols or text and the ability to use a layered approach *(C: Cognitive loading).*

Example from clinical practice: *"it's about understanding what he wants to say and how he wants to say it, checking his cognition and his memory"* 24, SLT

5.4.1.3 Topic: Physical Abilities

PHYSICAL ABILITIES	
Specialist Knowledge ***n*=10**	**Role** ***n*=4**

The category **physical abilities** is defined in this study as whole-body motor skills, encompassing: movement, strength, coordination, function and endurance.

Physical abilities were the sole domain of the OTs and were reported within **specialist knowledge** (OT, *n*=10, 50%) and **role** responses (OT, *n*=4, 20%). It was not reported by BEs or SLTs.

OTs reported **specialist knowledge** in relation to the:

i. analysis of what the user can physically achieve including posture and sitting balance *(C: Analysis of physical movements)*
ii. identification of reliable, functional movement *(C: Identification of reliable movements)*
iii. levels of fatigue *(C: Recognising impact of fatigue)*

Within the **role** responses they commented upon the:

i. assessment of physical abilities and potential for ongoing change *(C: Identify current and future motor skills)*;
ii. need to identify functional movement *(C: Ascertain functional movements)*

Example from clinical practice: "*instantly I'd be looking at them physically, their feet, their positioning…I see that as my role"* 34, OT

5.4.2 Concept: Professional Skills

The concept **professional skills** was derived from four topics, two of which, **Technology Familiarity** and **Holistic Approach,** were the same for **specialist knowledge** and **role**.

For both specialist knowledge and role, 14 categories were identified which, although similar, were not identical.

The total number of participants reporting on the concept professional skills indicates similar numbers of BEs and OTs and the least SLTs (BE, *n*=13, 65%; OT, *n*=14, 70%; SLT, *n*=8, 40%). A greater number of BEs and SLTs reported **specialist knowledge** (BE, *n*=10, 50%; SLT, *n*=8, 40%) than **role** (BE, *n*= 5, 25%; SLT, *n*=6, 30%). Fewer OTs reported specialist knowledge (OT, *n*=8, 40%) than role (OT, *n*=11, 55%).

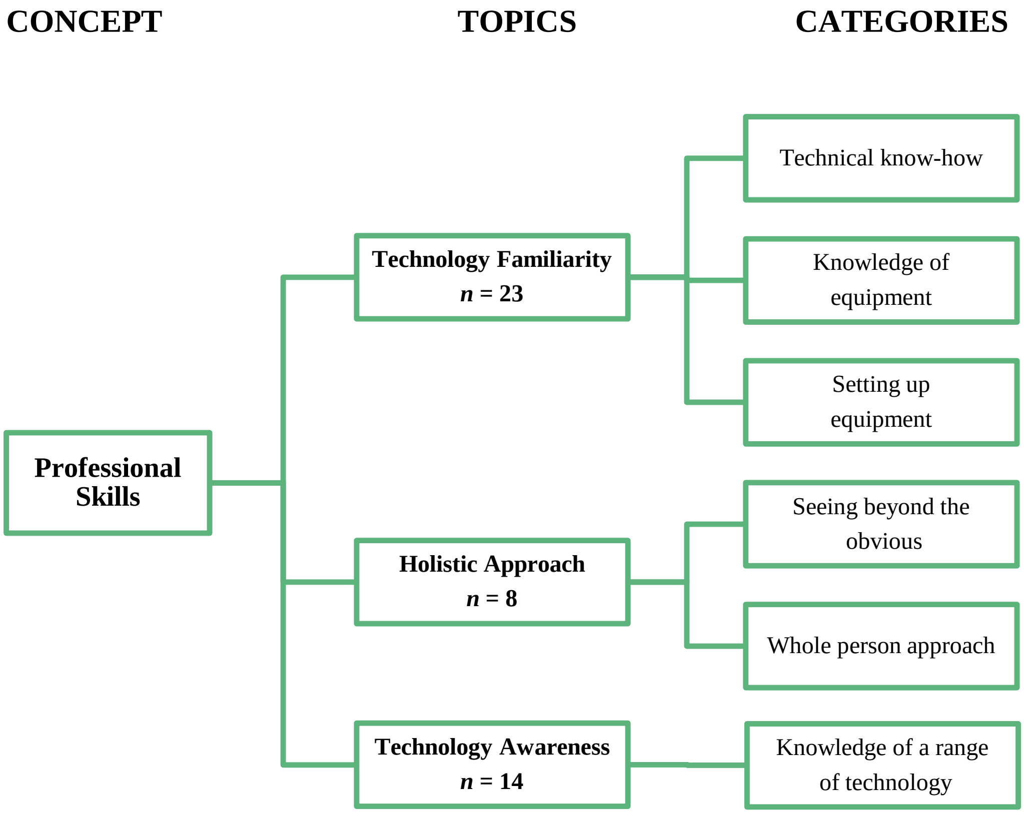

Figure 5.9: Thematic Content Analysis of **Specialist Knowledge** Responses Illustrating the Concept, Topics and Categories Derived from the Data

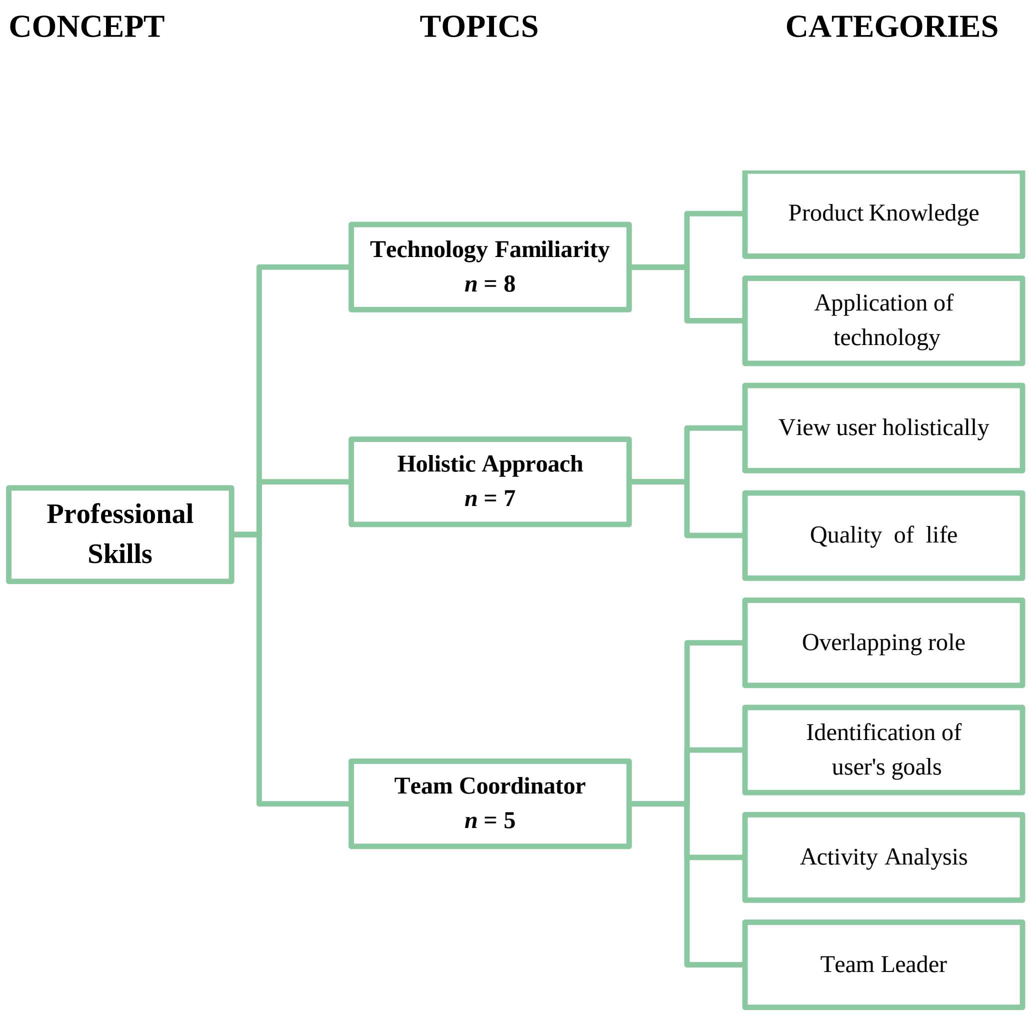

Figure 5.10: Thematic Content Analysis of **Role** Responses Illustrating the Concept, Topics and Categories Derived from the Data

5.4.2.1 Topic: Technology Familiarity

TECHNOLOGY FAMILIARITY	
Specialist Knowledge ***n*=23**	**Role** ***n*=8**

The category **Technology Familiarity** is defined in this study as a comprehensive "know how" working knowledge of high and low-tech equipment used within EAT.

All professions reported **specialist knowledge** of technology, in particular the BEs (BE, *n*=13, 65%; OT, *n*=4, 20%; SLT, *n*=6, 30%). Specialist knowledge differed between professions with the BEs reporting that their technical engineering skills enabled them to understand the workings of electronic equipment and to programme systems *(C: Technical know-how)*. They were conversant with the interfaces and overlapping functions between different devices *(C: Knowledge of equipment)* and specified particular knowledge of environmental control systems, powered wheelchair controls, computers and to a lesser extent, communication aids *(C: Setting up equipment).*

The SLTs stated that their knowledge and ability to set up equipment was primarily of communication aids vocabulary packages and to a lesser extent computer software access methods *(C: Setting up equipment).* They had knowledge of integrated systems requiring computer access *(C: Knowledge of equipment).*

The OTs reported knowledge of robotics, environmental control systems *(C: Knowledge of equipment)* and how to integrate such a system with wheelchair control *(C: Setting up equipment).*

All professions also reported a **role** (BE, *n*=3, 15%; OT, *n*=2, 10%; SLT, *n*=3, 15%). All reported a working knowledge of the particular technology which was reported in their specialist knowledge responses (*C: Product knowledge).* The SLTs also commented on the need to ensure that the communication aid was compatible with the EC system *(C: Application of technology).*

Example from clinical practice: *"having a knowledge of the limitations of the equipment"* 4, BE

5.4.2.2 Topic: Holistic Approach

HOLISTIC APPROACH	
Specialist Knowledge ***n*=10**	**Role** ***n*=7**

The category **holistic approach** is defined in this study as taking into consideration the psychological, physical and social influences upon the individual.

Specialist knowledge was reported the most by OTs and the least by BEs (BE, *n*=1, 5%; OT, *n*=5, 25%; SLT, *n*=4, 20%).

The OTs outlined their ability to see the "big picture" *(C: seeing beyond the obvious)* as well as the impact of the user's mood, lifestyle and their needs and priorities *(C: Whole person approach).* The SLTs and BE reported their knowledge in adopting a user-centred focus *(C: Whole person approach).*

Undertaking a holistic approach within their **role** was discussed only by the OTs (OT, *n*=7, 35%). They discussed the impact of technology upon the user, the need to incorporate a person-centred approach during assessment *(C: View user holistically)* and the impact upon quality of life *(C: Quality of Life).*

Example from clinical practice: *"it's looking at how assistive technology is going to benefit the client in a holistic way and its impact on the client as technology can be quite frightening"* 20, OT

5.4.2.3 Topic: Technology Awareness

TECHNOLOGY AWARENESS	
Specialist Knowledge ***n*=14**	**Role** ***n*=0**

The category, **technology awareness** is defined in this study as having a "know-what" knowledge of the range of EAT equipment available suitable for prescription.

Similar numbers of participants in all professions stated they had **specialist knowledge** (BE, *n*=4, 20%; OT, *n*=4, 20%; SLT, *n*=5, 25%). All professions reported that they were aware of the range of available equipment which may be suitable for prescription *(C: Knowledge of a range of technology).* It was not mentioned within the **role** responses and no clinical practice examples were provided.

5.4.2.4 Topic: Team Coordinator

TEAM COORDINATOR	
Specialist Knowledge ***n*=0**	**Role** ***n*=5**

The category **team coordinator** is defined in this study as the profession who leads and coordinates the personnel and activities involved in the assessment for EAT.

This category was primarily reported by the OTs under **role** with examples provided in the clinical practice responses (OT, *n*=4, 20%) whereas it was not mentioned by the BEs and only by 10% (SLT, *n*=2) of the SLTs under role.

The OTs reported that they have knowledge and skills in physical, cognitive and communication disorders and their role overlaps with the BEs in creating solutions *(C: Overlapping role)*. They stated that they are skilled in identifying the user's goal *(C: Identification of user goals)* and in activity analysis *(C: Activity Analysis)* and can provide guidance to other professionals. They are central to the team, can ensure that the right questions are asked and take the lead and coordinate the team *(C: Team Leader).*

> **Example from clinical practice:** *" I will interject if I feel the [user] is not understanding…as I feel you can get carried away with jargon…as I think people tend not to ask what does it mean",* 17, OT

5.4.3 Concept: Equipment Prescription

The concept **equipment prescription** was derived from six **topics,** five which were the same for specialist knowledge and role. For both specialist knowledge and role, 21 categories were identified, which although similar, were not identical.

The total number of participants reporting on the concept **equipment prescription** exhibited the greatest number of BEs and the least SLTs (BE, *n*=19, 95%; OT, *n*=15, 75%; SLT, *n*=12, 60%). At least 50% of participants from all professions reported **specialist knowledge** in this area (BE, *n*= 11, 55%; OT, *n*=11, 55%; SLT, *n*=10, 50%) which differed from the reporting of **role** (BE, *n*= 13, 65%; OT, *n*=8, 40%; SLT, *n*=4, 20%). Figures 5.10 and 5.11 show the coding for each question.

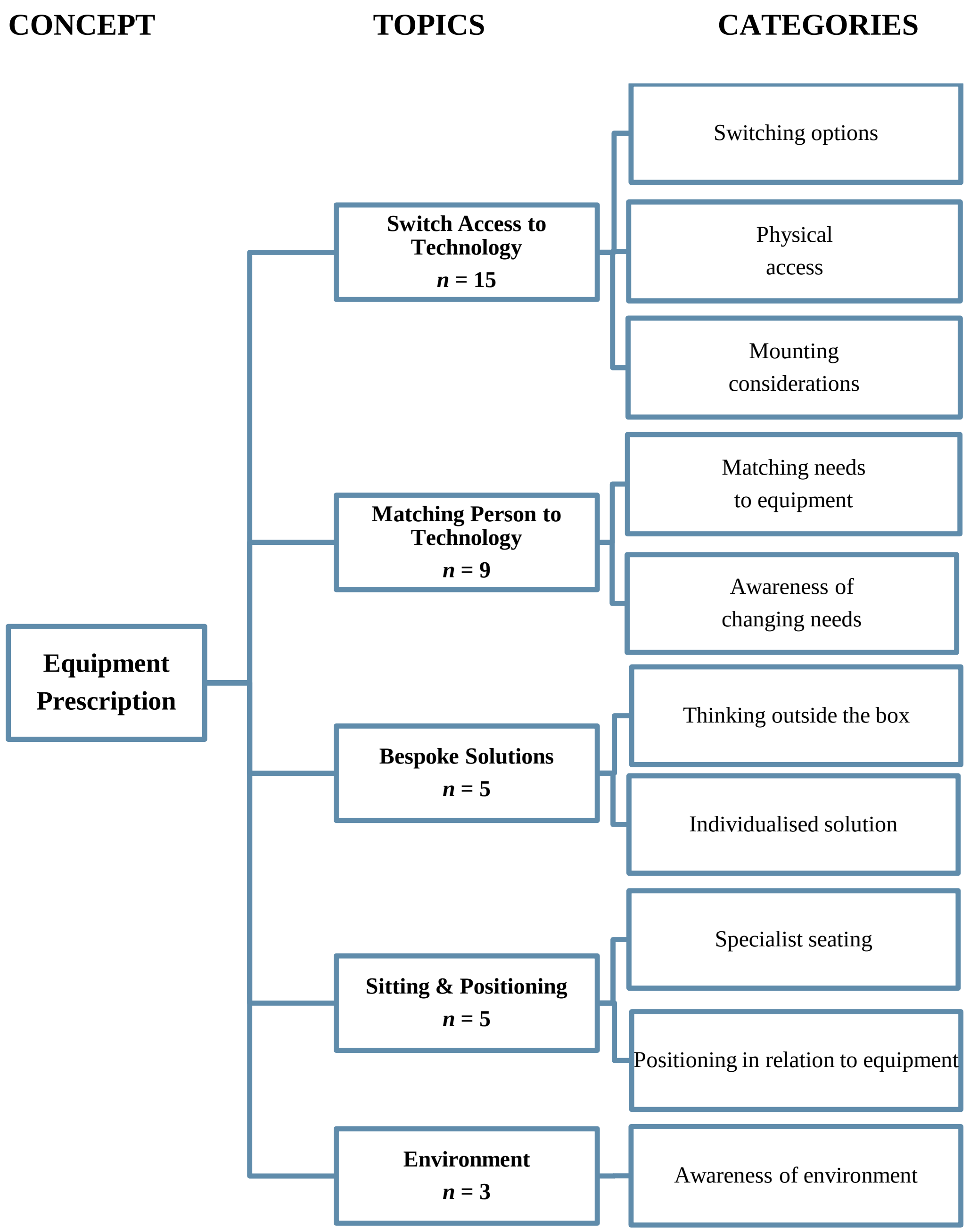

Figure 5.11 Thematic Content Analysis of **Specialist Knowledge** Responses Illustrating the Concept, Topics and Categories Derived from the Data

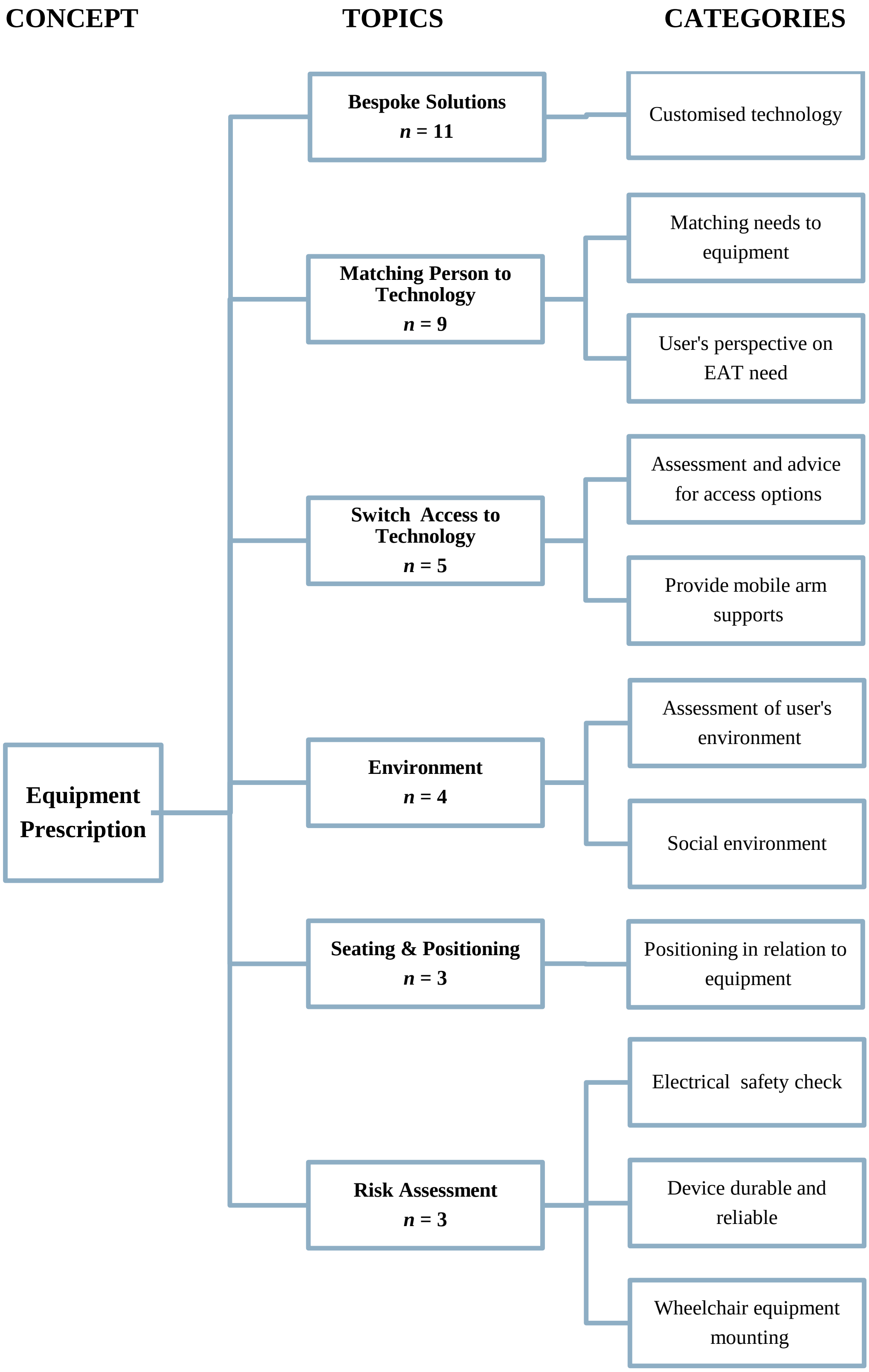

Figure 5.12: Thematic Content Analysis of **Role** Responses Illustrating the Concept, Topics and Categories Derived from the Data

5.4.3.1 Topic: Switch access to technology

SWITCH ACCESS TO TECHNOLOGY	
Specialist Knowledge ***n*=15**	**Role** ***n*=5**

The category, **switch access to technology** is defined in this study as the method by which the user is enabled to operate the equipment by using an interface device.

A similar number from all professions reported **specialist knowledge** (BE, *n*=4, 20%; OT, *n*=6, 30%; SLT, *n*=6, 30%).

The OTs and SLTs reported their specialist knowledge identifying suitable switches based upon useable movement. The BEs stated that their specialist knowledge was in enabling switch access to computers *(C: Switching options)*. The SLTs' focus was enabling communication and choice-making whereas the OTs' focus was independence. The OTs also specified their knowledge in facilitating switch access by:

i. assessment of physical functioning *(C: Physical access);*
ii. 24-hour postural management *(C: Physical access);*
iii. creation of splints *(C: Mounting considerations);*
iv. contra-indications for switch mounting *(C: Mounting considerations).*

No SLT indicated that switch access was their **role** in contrast to 20% of OTs and 5% of BEs (BE, *n*=1; OT, *n*=4; SLT, *n*=0).

The OTs indicated their role was:

i. the assessment of physical function, advising the team regarding the best switch access options *(C: Assessment and advice for access options);*
ii. assessing for mobile arm supports *(C: Provide mobile arm supports).*

The BEs reported their role as assessment in order to enable the user to access and control their environment *(C: Assessment and advice for access options).*

Example from clinical practice: *" tried different switches of different types…decided to use his foot as his switch, but they get damaged easily...had to find a robust switch and securely fix to ground"* 51, BE

5.4.3.2 Topic: Matching Person to Technology

MATCHING PERSON TO TECHNOLOGY	
Specialist Knowledge ***n*=9**	**Role** ***n*=9**

The category **matching person to technology** is defined in this study as the process of considering all aspects of a user's technological needs, wants and desires and identifying appropriate equipment based upon such information.

All professions reported on their **specialist knowledge** with little difference between the professions in numbers or content (BE, *n*=2, 10%; OT, *n*=3, 15%; SLT, *n*=4, 20%). All professions reported on the importance of ensuring the best fit between the user's needs, wants and desires and the proposed technology *(C: Matching needs to equipment).*

Awareness of the user's changing needs was raised by all professions *(C: Awareness of changing needs).*

Similarly, there was little difference in numbers between the professions on their **role** (BE, *n*=3, 15%; OT, *n*=2, 10%; SLT, *n*=4, 20%). However the content differed. The SLTs focused on communication; the BEs stated that their role was to provide technical expertise and a solution bridging a medical problem and the user's needs *(C: Matching needs to equipment)*. The OTs concentrated on the user's need for EAT and the importance of ascertaining if it was for safety or independence (*C: User's perspective on EAT need*).

Example from clinical practice: *"You're facilitating the process of assessment, extracting from the client their desires and wish list, trying to find out what is right for them and deciding if it's appropriate and safe to prescribe"* 3, OT

5.4.3.3 Topic: Bespoke Solution

BESPOKE SOLUTION	
Specialist Knowledge ***n*=5**	**Role** ***n=11***

The category **bespoke solution** is defined in this study as designing or customising electronic or mobility equipment based upon the user's specific needs.

This category was the sole domain of the BEs' **specialist knowledge** (BE, *n*=5, 35%; OT, *n*= 0; SLT, *n*=0) and **role** (BE, *n*=11, 55%; OT, *n*= 0; SLT, *n*=0).

The BEs reported that their specialist knowledge consisted of (*C: Thinking outside the box*):

i. "outside the box thinking";
ii. good spatial skills;
iii. working knowledge of electronics;
iv. problem-solving approach and lateral thinking;

Their aim was to provide "minimal assistive technology to maximise effective use" and ensure that the technology was fit for each individual user *(C: Individualised solution).*

Fifty-five percent of BEs (*n*=11) stated that developing a bespoke solution was a key feature of their **role** and reported four aspects *(C: Customised technology):*

i. detailed fact-finding from user regarding their requirements, regardless of available technology;
ii. advising the team regarding limitations of technology;
iii. changing obstacles reported by the team into technical solutions;
iv. maintaining a constant "can-do" technical approach.

Example from clinical practice: "*I will be brought into the picture when approaching the limits of what can be done to try and find a solution.*" 2, BE

5.4.3.4 Topic: Sitting and Positioning

SITTING AND POSITIONING	
Specialist Knowledge ***n*=6**	**Role** ***n*=3**

The category **sitting and positioning** is defined in this study as the postural and biomechanical configuration of the user when seated and positioned to use EAT.

This category was reported primarily by OTs in **specialist knowledge** (BE, *n*=1, 5%; OT, *n*=5, 35%; SLT, *n*=1, 5%) and **role** (BE, *n*=0; OT, *n*=3, 15%; SLT, *n*=0). The OTs considered they had **specialist knowledge** in understanding the physiology and anatomy of physical positioning and movement. One BE and SLT reported specialist knowledge in the management of wheelchair sitting and positioning *(C: Specialist seating).*

Fifteen percent of OTs (*n*=3) stated that their **role** involved management of the user's wheelchair positioning and postural control. No BE or SLT reported a role *(C: Positioning in relation to equipment).*

Example from clinical practice: *"taking responsibility for posture and seating, making sure that the seat is fit for purpose in terms of posture and not just engineering"* 58, BE

5.4.3.5 Topic: Environment

ENVIRONMENT	
Specialist Knowledge **_n_=3**	**Role** **_n_=4**

The category **environment** is defined in this study as the physical and social settings in which the user resides and spends time.

The environment was raised by few participants, predominately OTs (OT, *n*=5, 25%) in contrast to 10% of BEs (BE, *n*=2) and no SLTs. Two OTs (10%) considered that they had **specialist knowledge** in relation to assessing and considering the implications for EAT within the user's natural environments. They and the BEs reported the importance of being aware of day and night-time environments *(C: Awareness of environment).*

The OTs stated that their **role** (*n*=3, 15%) was to assess the user in order to enable access to and control of their environment(s) *(C: Assessment of user's environments).* The BEs reported on the need to consider the impact of their social environment *(C: Social environment).*

Example from clinical practice: *"…what things he wants to control, what happens in his day….have a look at his environment and the things that need controlling"* 60, OT

5.4.3.6 Topic: Risk Assessment

RISK ASSESSMENT	
Specialist Knowledge ***n*=0**	**Role** ***n*=3**

The category **risk assessment** is defined in this study as the procedure undertaken in order to identify and manage risks inherent in the provision of EAT.

No participant reported **specialist knowledge** of risk assessment and 15% of BEs stated that it was their **role** (BE, *n*=3, 15%; OT, *n*=0; SLT, *n*=0). Their risk assessment included:

i. an electrical safety check of devices and peripherals *(C: electrical safety check)*
ii. ensuring that a device is technically safe, fit for purpose, durable and reliable *(C: device durable and reliable)*
iii. safety assessment of the wheelchair mounting system *(C: wheelchair equipment mounting)*

> **Example from clinical practice:** *"to ensure that anything that is provided is safe, fit for purpose and sustainable"   58, BE*

5.4.4 Concept: Implementation of Technology

The concept **implementation of technology** was derived from two topics, one of which, **Functional Usage** was the same for specialist knowledge and role. Seven categories were generated from the data. The total number of participants reporting on the concept **implementation of technology** was similar for BEs and SLTs with the greatest number being OTs (BE, *n*=8, 40%; OT, *n*=12, 60%; SLT, *n*=7, 35%). Few participants reported **specialist knowledge** (BE, *n*= 2, 10%; OT, *n*=4, 20%; SLT, *n*=6, 30%) but more reported a **role** (BE, *n*= 8, 40%; OT, *n*=12, 60%; SLT, *n*=7, 35%) within the implementation of technology.

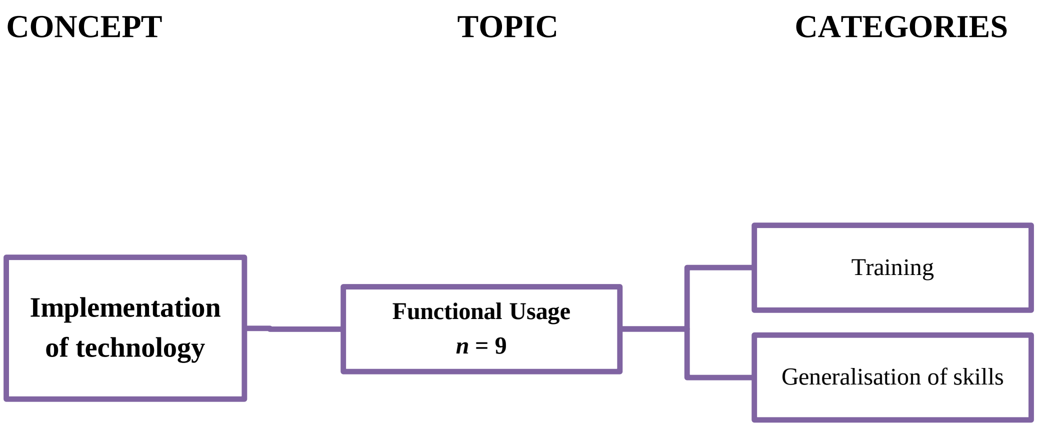

Figure 5.13: Thematic Content Analysis of **Specialist Knowledge** Responses Illustrating the Concept, Topics and Categories Derived from the Data

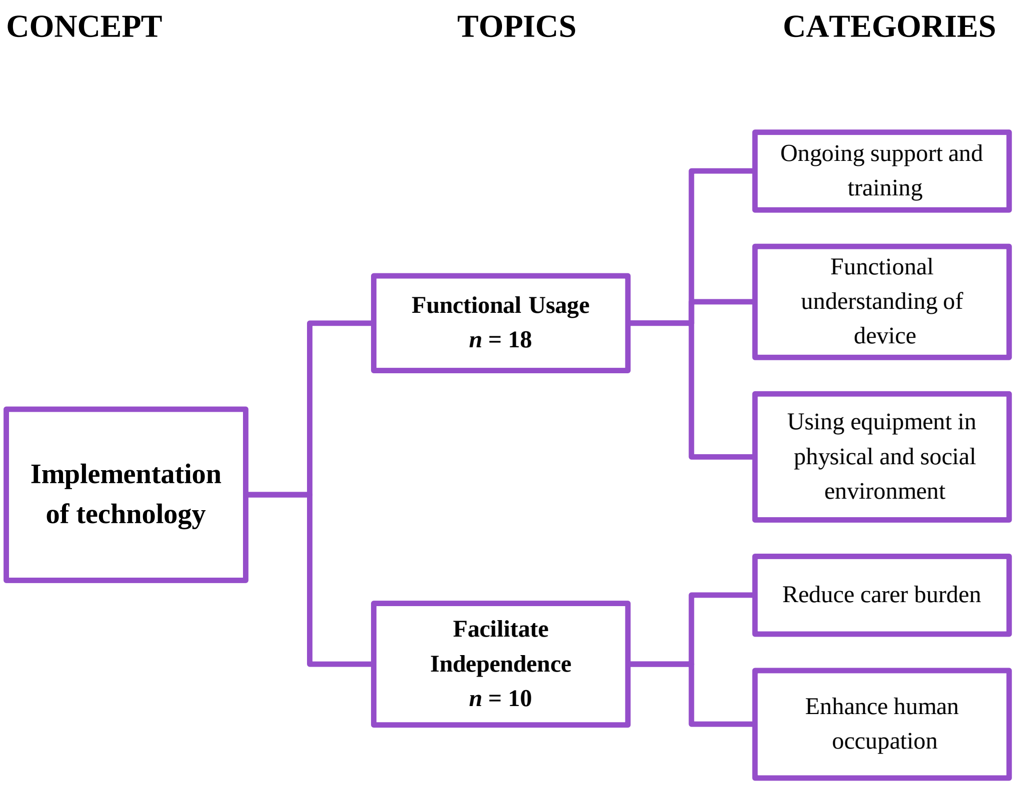

Figure 5.14: Thematic Content Analysis of **Role** Responses Illustrating the Concept, Topics and Categories Derived from the Data

5.4.4.1 Topic: Functional Usage

FUNCTIONAL USAGE	
Specialist Knowledge ***n*=9**	**Role** ***n*=18**

The category, **functional usage** is defined in this study as the successful everyday use of the technology in order to meet the user's wants, needs and desires.

This category was reported in the greatest number by SLTs (*n*=14, 70%) and the least by BEs (*n*=3, 15%).

Twenty-five percent of SLTs (*n*=5) and 15% of OTs (*n*=3) reported that their **specialist knowledge** included training for the user and their family *(C: Training)* and regular practice sessions to enable progression from assessment to functional generalisation of the use of the technology. The SLTs described their knowledge of communication aid vocabulary packages and the development of bespoke linguistic setups for each user in order to aid functional use *(C: Generalisation of skills)*. They also stated that they enabled team members to develop their skills with communication aids by providing support and training *(C: Training)*.

All professions (BE, *n*=3, 15%; OT, *n*=6, 30%; SLT, *n*=9, 45%) reported that their **role** included training for the user, their family and the professional team. The SLTs stated that they would model effective use of the device and would offer ongoing support for the lifetime of the technology *(C: Ongoing support and training)* .They stated that this would involve joint working in order to teach different functions of the technology. The BEs focus was on the technical aspects of the device, the OT on accessing ongoing technical support and training and the SLT on use of the communication functions *(C: Functional understanding of device).* The OTs and SLTs reported on the importance of working with the user in their different environments to ensure functional usage *(C: Using equipment in physical and social environment).*

Example from clinical practice: *"it's essential to move from prescription to functional use of the aid"* 13, SLT

5.4.4.2 Topic: Facilitate Independence

FACILITATE INDEPENDENCE	
Specialist Knowledge ***n*=0**	**Role** ***n*=10**

The category **facilitate independence** is defined in this study as an approach to EAT provision which seeks to enable the user to become less dependent upon others and more self-reliant.

No profession reported **specialist knowledge** and 30% of the BEs (*n*=6) and 20% (*n*=4) of the OTs reported facilitating independence as their **role** in the provision of EAT.

The BEs reported how their role facilitates independence by providing a safe and secure environment, a reduction in the burden for carers, enabling the user to perform functions which they need or desire *(C: Reduce carer burden*). The OTs considered the independence within the home and how EAT can assist with fulfilling the roles of human occupation, for example, maternal duties *(C: Enhance human occupation).*

> **Example from clinical practice:** *"I saw my role as helping her [user's wife] to get out, with the peace of mind that he could contact her …and where he could be left alone but could have access to things in different rooms as well"* 52, BE

5.5 Item Emerging from Clinical Practice Data: Working Together as a Team

The importance of joint working and making team-based decisions was reported by 38% (*n*=23) of participants (BE, *n*=4; OT, *n*=9; SLT, *n*=10) while providing examples of clinical practice. It was the only issue reported during clinical practice examples not to arise under the specialist knowledge or role responses.

All professions reported on the need for a team-based approach to the assessment and provision of EAT equipment. The BEs described their collaborative work with OTs and SLTs in order to assist in the identification of the user's physical and communication limitations, and options for computer access. They described the provision of technical support for the OTs and SLTs as required. The OTs stated that they worked closely with: 1) the BEs and SLTs to ensure that the equipment was switch accessible and 2) their on-going liaison with Social Services for provision of additional AT. The SLTs reported close collaboration with the OTs for switch access, the BEs for advice and input on mounting solutions and the physiotherapist for management of physical abilities.

5.6 Conclusions

This is the first reported study investigating the specialist knowledge and role of professions involved in the assessment for EAT. The sample size consisted of sample saturation of BEs and enabled data saturation for all professions. The sample population (*n*=60) were recruited from two types of settings; assistive technology centres (*n*=45, 75%) and brain injury units (*n*=15, 25%) across England. The level of self-rated expertise differed significantly between the two settings with no Experts in the BIUs and no Beginners in the ATCs. The greatest number of those identified as "Accomplished" worked in ATCs. There is no significant association between the participants' years of ABI experience and their self–rating of expertise with the years of experience in EAT is significantly associated with their self-rated expertise. Four concepts emerged from the specialist knowledge and role data addressing assessment, professional skills and equipment. Technical engineering skills, assessment and management of physical abilities and communication were the areas which were considered to be the sole specialist knowledge domains of the BE, OT and SLT professions respectively. Mutual recognition of such specialist knowledge was evident among all professions. All other areas of specialist knowledge were common to all professions, although one profession was either generally dominant or different aspects were reported by all professions. The responses for role also report differences and similarities between the professions with one profession taking the lead role in five areas with two or more professions sharing roles in all other areas.

BEs were responsible for promoting independence by ensuring that the user could access an appropriate device, which may require technical customisation. They emphasised the importance of the BE having a thorough technical knowledge of the available technology and recognised their role in supporting other team members.

The OTs advocated a holistic approach to ensure that the user's psychological, physical and social needs were addressed. They suggested that the OT makes an effective team leader as they have knowledge and skills in common with the BE and SLT and that the blurring of professional boundaries can be helpful within the assessment for EAT. Fewer OTs than SLT considered they had specialist knowledge or a role in relation to matching the person to the technology which appears counter-intuitive. However, as forty-five percent (n=9) of OTs and only 30% (n=6) of SLTs worked in a BIU this result may reflect the broader demands placed upon the OTs given the diverse nature of the workload within this setting.

The SLTs reported utilising their knowledge of speech, language and communication disorders in order to ensure that the configuration, vocabulary and complexity of the device software is appropriate to the user's needs. They promoted the benefits of joint teamwork and were keen to ensure that the user developed successful communication by offering training and support also to their families.

5.7 Chapter Summary

This chapter presented the results of Study 1 which considered the participants' experience (in years) of EAT and ABI; their perception of their level of expertise and their reported specialist knowledge and role in the assessment for EAT. The findings will be discussed in Chapter 8. The following two chapters contain the methodology and results for Study 2 which is an investigation of the content and process of the participant's clinical decision making.

Chapter 6

Methodology Study 2: An Investigation of the Content and Process of Clinical Decision Making

6.1 Introduction

This chapter presents the methodology for Study 2 which investigates the content and process of clinical decision making knowledge during assessment for EAT.

6.2 Method

6.2.1 Design: Concurrent Verbal Protocol Analysis

Concurrent verbal protocol analysis, using thinking-aloud to investigate the content and process of the participants' decision making during assessment for electronic assistive technology.

6.2.2 Participants

A purposive sample of 60 professionals was employed using the same participants as Study 1. See Chapter 5 for full details.

6.2.2.1 Ethical and Research and Development Approval

The application for NRES ethical and R&D approval for this study was combined with the application for Study 1 and the full details can be seen in Chapter 4, Section 4.2.2.4. The study received NRES ethical and R&D approval from 10 NHS Trusts.

6.3 Procedure

6.3.1 Data Collection

Data collection was carried out contemporaneously with Study 1 and each participant was seen within the same quiet room. On average, data collection took 75 minutes. An explanation of concurrent verbal protocol analysis and the "thinking -aloud" process was provided. Consent was obtained as outlined in Study 1. All think-aloud sessions were audio recorded using a Philips Voicetracer 7675 digital voice recorder .

6.3.2 Case Scenarios: Practice Task

In order to practice thinking aloud to ensure that each participant had an understanding of how it differed from providing a commentary of their thinking or an explanation of what they would do, three practice tasks were undertaken. The first two practice tasks were those recommended by (Ericsson and Simon, 1993) in which all participants were given the following instructions:

- Task 1. "Multiply 24 x 36 and instead of working it out in your head and then giving an answer, work it out by thinking aloud";
- Task 2. "How many windows are in your (parent's) house? Keep thinking aloud as you work this out".

The third task consisted of a short practice case scenario. It was written and audio and video-enhanced, and was in the same format as the two used in the main study. All participants were given the same verbal instructions and written case information.

The **verbal instruction** given to each participant was:

> "I'm going to give you typical written referral information in addition to a short video of their physical status and a speech recording. Your task is to work out what equipment you would prescribe for this man / woman. I would like you to read, watch and listen to all the information available. I want you to start thinking aloud as soon as you begin to read and continue as you watch and listen. If you stop thinking aloud for any length of time I will remind you to continue and will say "keep thinking aloud". You can make notes if you wish. If you need further information you can ask me as I have his / her records. If you ask for any information I need you to make clear your reason for asking. I'll give you an answer if I can but I won't get involved in conversation. The most important thing is to keep thinking aloud at all times. So, imagine that you have been asked to assess this person. I want you to do what you would typically do in clinical practice."

Their **written case information**, although specific for each case scenario, followed the same format across all case scenarios. The case information for the practice case scenario is below:

> Jeff is due to be discharged home from hospital within the next four weeks. His main need for assistive technology is communication and he wants to communicate both inside and outside his home environment. Keep thinking aloud as you assess and decide what type of equipment you would prescribe for him. You may finish when you arrive at a decision.

The video footage and speech sample were set up on a laptop and were ready to view or listen to at their request. They were able to watch and listen more than once if desired and pause at any stage. They were reminded to keep thinking aloud while watching and listening. If the participant began to provide a commentary or an explanation they were stopped and reminded to think aloud only and continue practicing. Participants were then asked if they felt they knew what they needed to do and all agreed at that point to continue with the actual study. Therefore it was deemed that these three tasks were sufficient to enable the participants to grasp and practice the thinking-aloud process.

No eye contact occurred during the thinking aloud and the researcher sat at a right angle to the participant, with head bowed, in order to limit the opportunity for natural eye contact. Participants could ask questions to supplement the information given on the enhanced case scenarios. However, in order to avoid dialogue a standardised response was provided. If the participant was silent for more than 30 seconds, the researcher asked them to "keep thinking aloud."

6.3.3 Case scenarios: Main Study

Subsequent to the completion of the practice tasks, the participants were given, in a random order, the two enhanced case scenarios; A and B. The same procedure was undertaken as for the practice scenario.

6.4 Materials

6.4.1 Video Footage and audio-enhanced written case scenarios

Two written case scenarios, enhanced with the use of video footage and audio speech samples were used during data collection. Each case scenario given to the participants provided typical referral information for an adult presenting with a range of difficulties subsequent to an acquired brain injury and preparing for discharge from hospital. Details of content development are in Chapter 3, Section 3.6.6. Tables 6.1 and 6.2 present the two written case scenarios.

Table 6.1: Participant's Written Case Scenario A

NAME	Jordan
DOB / AGE	19/1/1990 – 19
FAMILY BACKGROUND	Jordan lives in a high rise flat in an inner city area with his mother and 14 year-old sister. An older brother lives away from home. His mother works fulltime as a shop assistant. His father lives in Nigeria with his second wife and family and visits occasionally.
CULTURAL AND LINGUISTIC BACKGROUND	Jordan is originally from Nigeria and has lived in the UK since he was 9 years old. His first language is English and although he understands Yoruba, he cannot speak much Yoruba.
MEDICAL HISTORY	Asthma
CURRENT MEDICAL HISTORY	1. Acquired brain injury (18 June 2007) He was involved in a fight and suffered extensive head injuries. Has been an inpatient at a specialist brain injury unit since Sept 2007. Due to be discharged home in 2 weeks' time. 2. Epilepsy 3. Mood swings
HEIGHT & WEIGHT	Height: 1.74 m / 5.7 ft Weight: 70 kg / 11.2 stone
MEDICATIONS	Carbamazepine Phenytoin Beclomethasone Dipropionate Inhaler Salbutamol Inhaler Senna
COMMUNICATION	Jordan has severe lower motor neurone dysarthria which limits his functional ability to communicate. He is intelligible to those familiar to him at a two-word level but to those unfamiliar to him, this decreases to a one-word level. The severity of his hypernasality is a major compounding factor.
PHYSICAL STATUS	He has decreased tone bilaterally in upper and lower limbs and he tends to head-drop after approximately five minutes. His trunk control is very poor with no sitting balance, a few degrees of right shoulder flexion in sitting and 15 degrees of left shoulder abduction. His hand function is severely limited and essentially non-functional (flickers of finger flexion only). He has no functional movement in his lower limbs.

Table 6.2: Researcher's Expanded Practice Written Case Scenario A

NAME	**Jordan**
BEHAVIOURAL AND EMOTIONAL STATUS	
EMOTIONAL STATUS	Jordan is extremely labile, has poor emotional control and suffers from mood swings.
COGNITIVE & SENSORY	
COGNITIVE ABILITIES	Jordan's attention and memory are good. His problem-solving skills are also good but are less reliable and dependent upon his mood. His speed of information processing is somewhat reduced. Relearning ability good. He occasionally displays sexually disinhibited behaviour.
EMPLOYMENT OR EDUCATION	
EMPLOYMENT / EDUCATION	Student at College taking BTEC National Diploma in Sports Development and Fitness. He would like to resume his studies although he is aware that he may have to change his focus of study.
FINANCIAL STATUS	
FINANCIAL SITUATION	Jordan's mother has applied for statutory benefits and the family are eligible to receive the following: ▪ Income Support ▪ Housing Benefit ▪ Council Tax Benefit ▪ Disability Living Allowance ▪ Direct Payments It is anticipated that future care will be jointly funded by his local PCT and Social Services. His Social Worker has submitted a claim 2/52 ago for Criminal Injury Compensation to the Criminal Injuries Compensation Authority.
HOME SITUATION	
HOME SITUATION	Jordan and his family are due to be rehoused in suitable ground floor accommodation as close to his original home as possible.
HOME CARE	A full care package has been agreed which will involve a Support Worker coming to the house on a daily basis for up to 16 hours.

MEDICATION SIDE-EFFECTS	
MEDICATION SIDE-EFFECTS	There are no side effects from the medications.
PERSONAL ACTIVITIES OF DAILY LIVING	
PERSONAL ACTIVITIES OF DAILY LIVING	Jordan requires full assistance with PADL. He would like to be able to be more independent with feeding.
TOILETING	Jordan is incontinent of urine and wears a catheter with a leg bag.
FEEDING	Jordan receives all nutrition via PEG feeding, typically overnight. He is able to take small amounts of yogurt and ice-cream for pleasure.
SEATING AND TRANSFERS	
SEATING	Jordan spends the majority of his day in his wheelchair and currently uses a tilt in space wheelchair. He has a head rest and lateral trunk supports and lapstrap. He is undergoing a review at the Special Seating service prior to discharge.
TRANSFER	He is hoisted for all transfers.
SENSORY ABILITIES	
PERCEPTUAL SYMPTOMS	Jordan reports difficulty with his sense of smell.
SENSORY ABILITIES	Hearing intact Vision intact Sensation and proprioception are intact.
SOCIAL INTERESTS	
FRIENDS	His mother reports that he is finding it hard to maintain his friendships. Jordan reports that when friends visit they have difficulty understanding him and get impatient with the Lightwriter.
LEISURE INTERESTS	Gaming, basketball, listening to music, chat rooms, MSN
THERAPEUTIC INPUT	
THERAPY TEAM	He has been referred to the community therapy team and will receive ongoing input from the OT, SLT, PT and Neuro Psychologist. He will also have access back to regional assistive technology team.

USE OF TECHNOLOGY	
CURRENT TECHNOLOGY USAGE	He is currently using a scanning Lightwriter SL85 (text to speech communication aid) to communicate. He operates it by activating a switch using minimal sideways movement of his left arm. Has recently tried using the computer in the rehab unit for emailing friends using switch access. QWERTY keyboard Row / column scanning Word prediction after 3 letters DECtalk English Scan speed 5
PERSONAL REQUESTS FOR ELECTRONIC ASSISTIVE TECHNOLOGY	Access to the PC for education and leisure plus EC for his room and home including door opening, TV, phone, curtains, music and gaming on PS3 / Wii
PREVIOUS TECHNOLOGY USE	Jordan was familiar with using the PC for internet / email. He used an iPod and enjoyed gaming on computer and PS2.

ASSESSMENT RESULTS AND OUTCOME MEASUREMENT SCORES

1. BECK DEPRESSION INVENTORY

1. 0 I do not feel sad.
   1 I feel sad
   2 I am sad all the time and I can't snap out of it.
   3 I am so sad and unhappy that I can't stand it.

2. 0 I am not particularly discouraged about the future.
   1 I feel discouraged about the future.
   2 I feel I have nothing to look forward to.
   3 I feel the future is hopeless and that things cannot improve.

3. 0 I do not feel like a failure.
   1 I feel I have failed more than the average person.
   2 As I look back on my life, all I can see is a lot of failures.
   3 I feel I am a complete failure as a person.

4. 0 I get as much satisfaction out of things as I used to.
   1 I don't enjoy things the way I used to.
   2 I don't get real satisfaction out of anything anymore.
   3 I am dissatisfied or bored with everything.

5. 0 I don't feel particularly guilty
   1 I feel guilty a good part of the time.
   2 I feel quite guilty most of the time.
   3 I feel guilty all of the time.

6. 0 I don't feel I am being punished.
   1 I feel I may be punished.
   2 I expect to be punished.
   3 I feel I am being punished.

7 0 I don't feel disappointed in myself.
   1 I am disappointed in myself.
   2 I am disgusted with myself.
   3 I hate myself.

8. 0 I don't feel I am any worse than anybody else.
   1 I am critical of myself for my weaknesses or mistakes.
   2 I blame myself all the time for my faults.
   3 I blame myself for everything bad that happens.

9. 0 I don't have any thoughts of killing myself.
1 I have thoughts of killing myself, but I would not carry them out.
2 I would like to kill myself.
3 I would kill myself if I had the chance.

10. 0 I don't cry any more than usual.
1 I cry more now than I used to.
2 I cry all the time now.
3 I used to be able to cry, but now I can't cry even though I want to.

11. 0 I am no more irritated by things than I ever was.
1 I am slightly more irritated now than usual.
2 I am quite annoyed or irritated a good deal of the time.
3 I feel irritated all the time.

12. 0 I have not lost interest in other people.
1 I am less interested in other people than I used to be.
2 I have lost most of my interest in other people.
3 I have lost all of my interest in other people.

13. 0 I make decisions about as well as I ever could.
1 I put off making decisions more than I used to.
2 I have greater difficulty in making decisions more than I used to.
3 I can't make decisions at all anymore.

14. 0 I don't feel that I look any worse than I used to.
1 I am worried that I am looking old or unattractive.
2 I feel that there are permanent changes in my appearance that make me look unattractive.
3 I believe that I look ugly.

15. 0 I can work about as well as before.
1 It takes an extra effort to get started at doing something.
2 I have to push myself very hard to do anything.
3 I can't do any work at all.

16. 0 I can sleep as well as usual.
1 I don't sleep as well as I used to.
2 I wake up 1-2 hours earlier than usual and find it hard to get back to sleep.
3 I wake up several hours earlier than I used to and cannot get back to sleep.

17. 0 I don't get more tired than usual.
1 I get tired more easily than I used to.

2 I get tired from doing almost anything.
3 I am too tired to do anything.

18. 0 My appetite is no worse than usual.
1 My appetite is not as good as it used to be.
2 My appetite is much worse now.
3 I have no appetite at all anymore.

19. 0 I haven't lost much weight, if any, lately.
1 I have lost more than five pounds.
2 I have lost more than ten pounds.
3 I have lost more than fifteen pounds.

20. 0 I am no more worried about my health than usual.
1 I am worried about physical problems such as aches and pains, or upset stomach, or constipation.
2 I am very worried about physical problems and it's hard to think of much else.
3 I am so worried about my physical problems that I cannot think about anything else.

21. 0 I have not noticed any recent change in my interest in sex.
1 I am less interested in sex than I used to be.
2 I have almost no interest in sex.
3 I have lost interest in sex completely.

Total Score 26

Levels of Depression

1-10 ____________________These ups and downs are considered normal
11-16 ___________________ Mild mood disturbance
17-20 ___________________ Borderline clinical depression
21-30 ___________________ Moderate depression
31-40 ___________________ Severe depression
over 40__________________ Extreme depression

2. HOSPITAL ANXIETY AND DEPRESSION SCALE (HADS)

I feel tense or wound up

- Most of the time
- A lot of the time
- From time to time
- Not at all

I still enjoy the things I used to enjoy

- Definitely as much
- Not quite so much
- Only a little
- Hardly at all

I get a sort of frightened feeling as if something awful is about to happen

- Very definitely and quite badly
- Yes, but not too badly
- A little, but it doesn't worry me
- Not at all

I can laugh and see the funny side of things

- As much as I always could
- Not quite as much now
- Defiantly not so much now
- Not at all

Worrying thoughts go through my mind

- A great deal of the time
- A lot of the time
- From time to time but not too often
- Only occasionally

I feel cheerful

- Not at all
- Not often
- Sometimes
- Most of the time

I can sit at ease and feel relaxed

- Definitely
- Usually
- Not often
- Not at all

I feel as if I am slowed down

- Nearly all the time
- Very often
- Sometimes
- Not at all

I get a sort of frightened feeling like butterflies in the stomach

- Not at all
- Occasionally
- Quite often
- Very often

I have lost interest in my appearance

- Definitely
- I don't take as much care as I should
- I may not take quite as much care
- I take just as much care as ever

I feel restless as if I have to be on the move

- Very much indeed
- Quite a lot
- Not very much
- Not at all

I look forward with enjoyment to things

- As much as I ever did
- Rather less than I used to
- Definitely less than I used to
- Hardly at all

I get sudden feelings of panic

- Very often indeed
- Quite often
- Not very often
- Not at all

I can enjoy a good book or radio or TV programme

- Often
- Sometimes
- Not often
- Very seldom

3. FIM / FAM SCORES

SELF CARE ITEMS	**SCORE**
Feeding	1
Grooming	1
Bathing	1
Dressing Upper Body	1
Dressing Lower Body	1
Toileting	1
Swallowing	1
SPHINCTER CONTROL	
Bladder Management	1
Bowel Management	1
MOBILITY ITEMS (Type of Transfer)	
Bed/Chair/Wheelchair	1
Toilet	1
Shower	1
Car Transfer	1
LOCOMOTION	
Walking/Wheelchair	1
Stairs	1
Community Access	1
COMMUNICATION ITEMS	
Comprehension-Audio/Visual	6
Expression-Verbal, Non-Verbal	1
Reading	6
Writing	1
Speech Intelligibility	1
PSYCHOSOCIAL ADJUSTMENT	
Social Interaction	3
Emotional Status	3
Adjustment to Limitations	3
Employability	1
COGNITIVE FUNCTION	
Problem Solving	5
Memory	6
Orientation	6
Attention	6
Safety Judgment	5

Scale:

7 Complete Independence (timely, safely)

6 Modified Independence (extra time, devices)

5 Supervision (cuing, coaxing, prompting),

4 Minimal Assist (performs 75% or more of task)

3 Moderate Assist (performs 50%-74% of task)

2 Maximal Assist (performs 25% to 49% of task)

1 Total Assist (performs less than 25% of task)

4. MOTOR ASSESSMENT SCALE

MOVEMENT SCORING SHEET

MOVEMENT	0	1	2	3	4	5	6
SUPINE TO SIDE LYING	x						
SUPINE TO SITTING OVER SIDE OF BED	x						
BALANCED SITTING	x						
SITTING TO STANDING	x						
WALKING	x						
UPPER ARM FUNCTION		x					
HAND MOVEMENTS	x						
ADVANCED HAND ACTIVITIES	x						

5. THERAPY OUTCOME MEASURES for DYSARTHRIA

IMPAIRMENT SCALE

0 Severe dysarthria : severe persistent articulatory /prosodic impairment. Inability to produce any distinguishable speech sounds. No oral motor control. No respiratory support for speech.

1 Severe / moderate dysarthria with consistent articulatory / prosodic impairment. Mostly open vowels with some consonant approximations / severe festination of speech. Extremely effortful or slow speech, only 1 or 2 words per breath. Severely limited motor control.

2 Moderate dysarthria with frequent episodes of articulatory / prosodic impairment. Most consonants attempted but poorly represented acoustically / moderate festination. Very slow speech, manages up to 4 words per breath. Moderate limitation oral motor control.

3 Moderate / mild dysarthria: consistent omission / articulation of consonants. Variability of speed. Mild limitation of oral motor control or prosodic impairment.

4 Mild dysarthria: slight or occasional omission / mispronunciation of consonants. Slight or occasional difficulty with oral motor control /prosody or respiratory support.

5 No impairment

ACTIVITY SCALE

0 Unable to communicate in any way. No effective communication. No interaction

1 Occasionally able to make basic needs known with familiar or trained persons or trained listeners in familiar contexts. Minimal communication with maximal assistance.

2 Limited functional communication. Consistently able to make basic needs / conversation understood but is heavily dependent upon cues and context. Communicates betters with trained listener or family members or in familiar settings. Frequent repetition required. Maintains meaningful interaction related to here and now.

3 Consistently able to make needs known but can sometimes convey more information than this. Some inconsistency in unfamiliar settings. Is less dependent for intelligibility on cues and context. Occasional repetition required. Communicates beyond here / now with familiar persons, needs some cues and prompting.

4 Can be understood most of the time by any listener despite communication irregularities. Holds conversation, requires some special consideration, particularly with a wider range of people.

5 Communicates effectively in all situations.

PARTICIPATION SCALE

0 Unable to fulfill and social/educational/family role. Not involved in decision making / no autonomy / no control over environment. No social integration.

1 Low self-confidence / poor self esteem/ upset/frustration/anger/distress/ embarrassment/concern/withdrawal teem/limited social integration/socially isolated/contributes to some basic and limited decisions. Cannot achieve potential in any situation.

2 Some self-confidence/some social integration/makes some decisions and influences control in familiar situations.

3 Some self-confidence, autonomy emerging. Makes decisions and has control of some aspects of life. Able to achieve some limited social integration/educational activities. Diffident over control over life. Needs encouragement to achieve potential.

4 Mostly confident, occasional difficulties integrating or in fulfilling social/role activity. Participating in all appropriate decisions. May have difficulty in achieving potential in some situations occasionally.

WELLBEING / DISTRESS SCALE

0 Severe constant: upset/frustration/anger/distress/ embarrassment/concern/withdrawal

1 Frequently severe: upset/frustration/anger/distress/ embarrassment/concern/withdrawal

2 Moderately consistent : upset/frustration/anger/distress/ embarrassment/concern/withdrawal

3 Moderate frequent: upset/frustration/anger/distress/ embarrassment/concern/withdrawal

4 Mild occasional: upset/frustration/anger/distress/ embarrassment/concern/withdrawal

5 No inappropriate: upset/frustration/anger/distress/ embarrassment/concern/withdrawal

6. RIVERMEAD PERCEPTUAL ASSESSMENT BATTERY

CLASSIFICATION of TASKS	TASK	MAXIMUM SCORE	SCORE	TIME LIMIT	TIME
Form Constancy	**Picture Matching**	**4**	**4**	**3**	**3**
	Object Matching	**4**	**4**	**3**	**3**
	Size Recognition	**4**	**4**	**3**	**3**
Colour Constancy	**Colour Matching**	**12**	**12**	**3**	**3**
Sequencing	**Series**	**4**	**4**	**3**	**3**
	Sequencing – Pictures	**4**	**4**	**3**	**3**
Object Completion	**Animal Halves**	**4**	**4**	**3**	**3**
	Missing Article	**4**	**4**	**3**	**3**
Figure Ground Discrimination	**Figure Ground Discrimination**	**4**	**3**	**3**	**3**
Body Image	**Body Image**	**6**	**5**	**3**	**3**
	Body Image	**6**	**5**	**3**	**3**
	Body Image Total	**12**	**10**	**6**	**6**
	Body Image - SI	**8**			
Inattention	**R/L Copying Shapes L**	**36**	**N/A**		
	R/L Copying Shapes R	**36**	**N/A**		
	R/L Copying Shapes Total	**72**	**N/A**	**5**	
	R/L Copying Words L	**16**	**N/A**		
	R/L Copying Shapes R	**16**	**N/A**		
	R/L Copying Shapes - Total	**32**	**N/A**	**5**	
	Cancellation		**N/A**		
Spatial Awarenesss	**3D Copying Selection**	**12**	**N/A**		
	3D Copying Orientation	**12**	**N/A**		
	3D Copying – Total	**24**	**N/A**	**3**	
	Cube Copying S	**9**	**N/A**		
	Cube Copying O	**9**	**N/A**		
	Cube Copying S	**9**	**N/A**		
	Cube Copying O	**9**	**N/A**		
	Cube Copying S	**9**	**N/A**		
	Cube Copying O	**9**	**N/A**		
	Cube Copying S	**9**	**N/A**		
	Cube Copying O	**9**	**N/A**		
	Cube Copying - Total	**72**	**N/A**		

Table 6.3: Participant's Written Case Scenario B

NAME	**Razia**
DOB / AGE	14/5/72 – 36
FAMILY BACKGROUND	Lives in semi-rural area in a large semi-detached house with her husband and three primary-age children (9,7,5 – girl/boy/boy)
CULTURAL AND LINGUISTIC BACKGROUND	Razia is married and comes from a close Asian family. Her parents live approximately eight miles away. She has two brothers who are married with children, one of whom lives in the UK and the other in Pakistan. Her in-laws live close by. The languages spoken at home are Urdu, English and Gujurati. Razia is fluent in English and Urdu.
MEDICAL HISTORY	Nil of note
CURRENT MEDICAL HISTORY	1. Acquired brain injury – (29 October 2007) Sustained closed head injury during a car pile up on the motorway on 29 October 2007. Razia was the only person in her car. She has been an inpatient in a Regional Rehabilitation Unit since December 2007 and is due to be discharged home within the next 3 weeks. 2. Epilepsy 3. Depression
HEIGHT / WEIGHT	Height: 1.60 m / 5.25 ft Weight: 64 kg / 10 stone
MEDICATIONS	Carbamazepine Citalopram Baclofen Tizanidine Fibrogel Gabapentin
COMMUNICATION	Her speech is essentially unintelligible as she has severe spastic/ataxic dysarthria. She is able to say a few single words, which are intelligible to those familiar with her. However, she also has mild aphasia which affects her ability to understand complex conversation although she can understand everyday conversation without any difficulty. Her reading and spelling have also been mildly affected.
PHYSICAL STATUS	Bilateral weakness in her upper limbs, poor trunk control and reduced sitting balance. There is increased flexor tone on the right upper limb, which tends towards a flexed position. She has gross movement of her left hand with decreased range and power, limited functional movement in her lower limbs with tone slightly increased and ankle clonus and occasional extensor spasm. She has had two treatments of botulinum toxin in her right biceps, in Dec 2007 and March 2008.

Table 6.4: Researcher's Expanded Written Case Scenario B

NAME	**Razia**
BEHAVIOURAL AND EMOTIONAL STATUS	
EMOTIONAL STATUS	Razia has periods where she becomes very low and suffers from clinical depression subsequent to her injury. She's had 3 such episodes since her RTA which have lasted around 2 weeks on each occasion. Her motivation and interest in the world around her is significantly lower during these periods.
COGNITIVE ABILITIES	
COGNITIVE ABILITIES	Razia presents with no significant cognitive difficulties. However, she does suffer from fatigue and can become irritable. She has good sustained and selective attention span.
EMPLOYMENT OR EDUCATION	
EMPLOYMENT / EDUCATION	Worked part-time as a solicitor with a local law firm.
FINANCIAL STATUS	
FINANCIAL SITUATION	Razia's husband is a car mechanic who owns and runs his own business. Since the accident they have lost Razia's income and are coping on the one salary. A claim for compensation has been lodged against the driver at fault. The Social Worker has also advised the family with regard to statutory allowances and she will receive the following on discharge: ▪ Incapacity Benefit ▪ Disability Living Allowance ▪ Direct Payments
HOME SITUATION	
HOME SITUATION	Razia will be returning home after discharge. She is currently waiting for building work to be completed at her house. The house is being extended and modified and she and her husband will be living on ground floor accommodation. The children's bedrooms will be upstairs.
HOME CARE	A home care package has been set up which will mean Razia will have a team of carers to provide support from 7am to 9pm for the first 3 months at home. It will then be reviewed at 3 months.
MEDICATION SIDE-EFFECTS	
MEDICATION SIDE-EFFECTS	There are no side effects from the medications.

PERSONAL ACTIVITIES OF DAILY LIVING	
PERSONAL ACTIVITIES OF DAILY LIVING	Razia requires assistance with all PADL. She has gross motor movement in her left hand and with hand over hand assistance can manage to hold a sponge and wash her face, brush her teeth and lightly brush her hair.
TOILETING	Razia is fully continent
FEEDING	Razia is able to eat a full normal oral diet but requires assistance to feed. Using modified cutlery and with hand over hand assistance she is able to grip and hold a soup spoon.
SEATING AND TRANSFERS	
SEATING	Razia was prescribed a powered wheelchair, with Jay back and lateral trunk supports just after her admission to the rehab unit. She uses her left hand to drive the wheelchair using adapted supersensitive joystick.
TRANSFER	Razia presently uses a standing hoist for her transfers from bed to chair, but is working towards independent standing transfers
SENSORY ABILITIES	
PERCEPTUAL SYMPTOMS	She has a left sided homonymous hemianopia.
SENSORY ABILITIES	Hearing intact. Vision – presents with a left homonymous hemianopia. Sensation and proprioception are intact.
SOCIAL INTERESTS	
FRIENDS	Many of her friends are local and also have young children. They have been to see her while at the rehab unit but apart from a few key friends they have begun to loose contact.
LEISURE INTERESTS	Reading, cooking, entertaining
THERAPEUTIC INPUT	
THERAPY TEAM	She has been referred to the community therapy team and will receive ongoing input from the OT, SLT, PT and Neuro Psychologist. She will also have access back to regional assistive technology team. She will attend a Headway Unit twice weekly when discharged.

USE OF TECHNOLOGY	
CURRENT TECHNOLOGY USAGE	She is currently using a scanning voice output communication aid – the MightyMo. She accesses this using a joystick and can select which phrase she wants to say by choosing the correct picture. She reports that it is too limited as it doesn't allow her to spontaneously create messages. 16 page overlay Row / column scanning method Slow scan
PERSONAL REQUESTS FOR ELECTRONIC ASSISTIVE TECHNOLOGY	A portable integrated system which allows her to communicate and control her environment and send and receive text messages.
PREVIOUS TECHNOLOGY USE	Razia was familiar with using a PC and mobile phone.

ASSESSMENT RESULTS AND OUTCOME MEASUREMENT SCORES

1. BECK DEPRESSION INVENTORY

1.
- 0 I do not feel sad.
- 1 I feel sad
- 2 I am sad all the time and I can't snap out of it.
- 3 I am so sad and unhappy that I can't stand it.

2.
- 0 I am not particularly discouraged about the future.
- 1 I feel discouraged about the future.
- 2 I feel I have nothing to look forward to.
- 3 I feel the future is hopeless and that things cannot improve.

3.
- 0 I do not feel like a failure.
- 1 I feel I have failed more than the average person.
- 2 As I look back on my life, all I can see is a lot of failures.
- 3 I feel I am a complete failure as a person.

4.
- 0 I get as much satisfaction out of things as I used to.
- 1 I don't enjoy things the way I used to.
- 2 I don't get real satisfaction out of anything anymore.
- 3 I am dissatisfied or bored with everything.

5.
- 0 I don't feel particularly guilty
- 1 I feel guilty a good part of the time.
- 2 I feel quite guilty most of the time.
- 3 I feel guilty all of the time.

6.
- 0 I don't feel I am being punished.
- 1 I feel I may be punished.
- 2 I expect to be punished.
- 3 I feel I am being punished.

7
- 0 I don't feel disappointed in myself.
- 1 I am disappointed in myself.
- 2 I am disgusted with myself.
- 3 I hate myself.

8.
- 0 I don't feel I am any worse than anybody else.
- 1 I am critical of myself for my weaknesses or mistakes.
- 2 I blame myself all the time for my faults.
- 3 I blame myself for everything bad that happens.

9. 0 I don't have any thoughts of killing myself.
1 I have thoughts of killing myself, but I would not carry them out.
2 I would like to kill myself.
3 I would kill myself if I had the chance.

10. 0 I don't cry any more than usual.
1 I cry more now than I used to.
2 I cry all the time now.
3 I used to be able to cry, but now I can't cry even though I want to.

11. 0 I am no more irritated by things than I ever was.
1 I am slightly more irritated now than usual.
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3 I feel irritated all the time.

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1 I put off making decisions more than I used to.
2 I have greater difficulty in making decisions more than I used to.
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14. 0 I don't feel that I look any worse than I used to.
1 I am worried that I am looking old or unattractive.
2 I feel that there are permanent changes in my appearance that make me look unattractive.
3 I believe that I look ugly.

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1 It takes an extra effort to get started at doing something.
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3 I wake up several hours earlier than I used to and cannot get back to sleep.

17. 0 I don't get more tired than usual.
1 I get tired more easily than I used to.

2 I get tired from doing almost anything.
3 I am too tired to do anything.

18. 0 My appetite is no worse than usual.
1 My appetite is not as good as it used to be.
2 My appetite is much worse now.
3 I have no appetite at all anymore.

19. 0 I haven't lost much weight, if any, lately.
1 I have lost more than five pounds.
2 I have lost more than ten pounds.
3 I have lost more than fifteen pounds.

20. 0 I am no more worried about my health than usual.
1 I am worried about physical problems such as aches and pains, or upset stomach, or constipation.
2 I am very worried about physical problems and it's hard to think of much else.
3 I am so worried about my physical problems that I cannot think about anything else.

21. 0 I have not noticed any recent change in my interest in sex.
1 I am less interested in sex than I used to be.
2 I have almost no interest in sex.
3 I have lost interest in sex completely.

Total Score 28

Levels of Depression

1-10 ____________________These ups and downs are considered normal
11-16 ____________________ Mild mood disturbance
17-20 ____________________ Borderline clinical depression
21-30 ____________________ Moderate depression
31-40 ____________________ Severe depression
over 40__________________ Extreme depression

2. HOSPITAL ANXIETY AND DEPRESSION SCALE (HADS)

I feel tense or wound up

- Most of the time
- A lot of the time
- From time to time
- Not at all

I still enjoy the things I used to enjoy

- Definitely as much
- Not quite so much
- Only a little
- Hardly at all

I get a sort of frightened feeling as if something awful is about to happen

- Very definitely and quite badly
- Yes, but not too badly
- A little, but it doesn't worry me
- Not at all

I can laugh and see the funny side of things

- As much as I always could
- Not quite as much now
- Defiantly not so much now
- Not at all

Worrying thoughts go through my mind

- A great deal of the time
- A lot of the time
- From time to time but not too often
- Only occasionally

I feel cheerful

- Not at all
- Not often
- Sometimes
- Most of the time

I can sit at ease and feel relaxed

- Definitely
- Usually
- Not often
- Not at all

I feel as if I am slowed down

- Nearly all the time
- Very often
- Sometimes
- Not at all

I get a sort of frightened feeling like butterflies in the stomach

- Not at all
- Occasionally
- Quite often
- Very often

I have lost interest in my appearance

- Definitely
- I don't take as much care as I should
- I may not take quite as much care
- I take just as much care as ever

I feel restless as if I have to be on the move

- Very much indeed
- Quite a lot
- Not very much
- Not at all

I look forward with enjoyment to things

- As much as I ever did
- Rather less than I used to
- Definitely less than I used to
- Hardly at all

I get sudden feelings of panic

- Very often indeed
- Quite often
- Not very often
- Not at all

I can enjoy a good book or radio or TV programme

- Often
- Sometimes
- Not often
- Very seldom

3. FIM / FAM SCORES

SELF CARE ITEMS	SCORE
Feeding	2
Grooming	2
Bathing	1
Dressing Upper Body	1
Dressing Lower Body	1
Toileting	2
Swallowing	6
SPHINCTER CONTROL	
Bladder Management	6
Bowel Management	6
MOBILITY ITEMS (Type of Transfer)	
Bed/Chair/Wheelchair	3
Toilet	2
Shower	2
Car Transfer	2
LOCOMOTION	
Walking/Wheelchair	2
Stairs	1
Community Access	1
COMMUNICATION ITEMS	
Comprehension-Audio/Visual	5
Expression-Verbal, Non-Verbal	1
Reading	5
Writing	5
Speech Intelligibility	1
PSYCHOSOCIAL ADJUSTMENT	
Social Interaction	3
Emotional Status	3
Adjustment to Limitations	3
Employability	1
COGNITIVE FUNCTION	
Problem Solving	5
Memory	6
Orientation	6
Attention	6
Safety Judgment	6

Scale:

7 Complete Independence (timely, safely)

6 Modified Independence (extra time, devices)

5 Supervision (cuing, coaxing, prompting),

4 Minimal Assist (performs 75% or more of task)

3 Moderate Assist (performs 50%-74% of task)

2 Maximal Assist (performs 25% to 49% of task)

1 Total Assist (performs less than 25% of task)

4. MOTOR ASSESSMENT SCALE

MOVEMENT SCORING SHEET

MOVEMENT	0	1	2	3	4	5	6
SUPINE TO SIDE LYING	x						
SUPINE TO SITTING OVER SIDE OF BED		x					
BALANCED SITTING		x					
SITTING TO STANDING	x						
WALKING	x						
UPPER ARM FUNCTION		x					
HAND MOVEMENTS		x					
ADVANCED HAND ACTIVITIES	x						

5. THERAPY OUTCOME MEASURES for DYSARTHRIA

IMPAIRMENT SCALE

0 Severe dysarthria : severe persistent articulatory /prosodic impairment. Inability to produce any distinguishable speech sounds. No oral motor control. No respiratory support for speech.

1 Severe / moderate dysarthria with consistent articulatory / prosodic impairment. Mostly open vowels with some consonant approximations / severe festination of speech. Extremely effortful or slow speech, only 1 or 2 words per breath. Severely limited motor control.

2 Moderate dysarthria with frequent episodes of articulatory / prosodic impairment. Most consonants attempted but poorly represented acoustically / moderate festination. Very slow speech, manages up to 4 words per breath. Moderate limitation oral motor control.

3 Moderate / mild dysarthria: consistent omission / articulation of consonants. Variability of speed. Mild limitation of oral motor control or prosodic impairment.

4 Mild dysarthria: slight or occasional omission / mispronunciation of consonants. Slight or occasional difficulty with oral motor control /prosody or respiratory support.

5 No impairment

ACTIVITY SCALE

0 Unable to communicate in any way. No effective communication. No interaction

1 Occasionally able to make basic needs known with familiar or trained persons or trained listeners in familiar contexts. Minimal communication with maximal assistance.

2 Limited functional communication. Consistently able to make basic needs / conversation understood but is heavily dependent upon cues and context. Communicates betters with trained listener or family

members or in familiar settings. Frequent repetition required. Maintains meaningful interaction related to here and now.

3 Consistently able to make needs known but can sometimes convey more information than this. Some inconsistency in unfamiliar settings. Is less dependent for intelligibility on cues and context. Occasional repetition required. Communicates beyond here / now with familiar persons, needs some cues and prompting.

4 Can be understood most of the time by any listener despite communication irregularities. Holds conversation, requires some special consideration, particularly with a wider range of people.

5 Communicates effectively in all situations.

PARTICIPATION SCALE

0 Unable to fulfill and social/educational/family role. Not involved in decision making / no autonomy / no control over environment. No social integration.

1 Low self-confidence / poor self esteem/ upset/frustration/anger/distress/ embarrassment/concern/withdrawal teem/limited social integration/socially isolated/contributes to some basic and limited decisions. Cannot achieve potential in any situation.

2 Some self-confidence/some social integration/makes some decisions and influences control in familiar situations.

3 Some self-confidence, autonomy emerging. Makes decisions and has control of some aspects of life. Able to achieve some limited social integration/educational activities. Diffident over control over life. Needs encouragement to achieve potential.

4 Mostly confident, occasional difficulties integrating or in fulfilling social/role activity. Participating in all appropriate decisions. May have difficulty in achieving potential in some situations occasionally.

WELLBEING / DISTRESS SCALE

0	Severe constant: upset/frustration/anger/distress/ embarrassment/concern/withdrawal
1	Frequently severe: upset/frustration/anger/distress/ embarrassment/concern/withdrawal
2	Moderately consistent : upset/frustration/anger/distress/ embarrassment/concern/withdrawal
3	Moderate frequent: upset/frustration/anger/distress/ embarrassment/concern/withdrawal
4	Mild occasional: upset/frustration/anger/distress/ embarrassment/concern/withdrawal
5	No inappropriate: upset/frustration/anger/distress/ embarrassment/concern/withdrawal

6. RIVERMEAD PERCEPTUAL ASSESSMENT BATTERY

CLASSIFICATION of TASKS	TASK	MAXIMUM SCORE	SCORE	TIME LIMIT	TIME
Form Constancy	Picture Matching	4	4	3	3
	Object Matching	4	4	3	3
	Size Recognition	4	4	3	3
Colour Constancy	Colour Matching	12	12	3	3
Sequencing	Series	4	4	3	3
	Sequencing – Pictures	4	4	3	3
Object Completion	Animal Halves	4	4	3	3
	Missing Article	4	4	3	3
Figure Ground Discrimination	Figure Ground Discrimination	4	3	3	3
Body Image	Body Image	6	5	3	3
	Body Image	6	5	3	3
	Body Image Total	12	10	6	6
	Body Image - SI	8			
Inattention	R/L Copying Shapes L	36	6		
	R/L Copying Shapes R	36	N/A		
	R/L Copying Shapes Total	72	6	5	5
	R/L Copying Words L	16	2		
	R/L Copying Shapes R	16	N/A		
	R/L Copying Shapes - Total	32	2	5	5
	Cancellation		4		
Spatial Awarenesss	3D Copying Selection	12	N/A		
	3D Copying Orientation	12	N/A		
	3D Copying – Total	24	N/A	3	
	Cube Copying S	9	N/A		
	Cube Copying O	9	N/A		
	Cube Copying S	9	N/A		
	Cube Copying O	9	N/A		
	Cube Copying S	9	N/A		
	Cube Copying O	9	N/A		
	Cube Copying S	9	N/A		
	Cube Copying O	9	N/A		
	Cube Copying - Total	72	N/A		

THERAPY OUTCOME MEASURES for APHASIA

IMPAIRMENT SCALE

0. Severe aphasia affecting all modalities: auditory and reading comprehension inconsistent even at one key word. No meaningful expression.

1. Severe aphasia: auditory and / or reading comprehension is consistent at one key word level. Occasionally understands and expresses limited amount.

2. Severe / Moderate aphasia: auditory and / or reading comprehension is consistent at a minimum of two to three key word level. Some limited verbal / and or written expression used appropriately and purposefully.

3. Moderate aphasia: Constant auditory and / or reading comprehension for simple sentences and structures. Inconsistent with complex commands and structures. Consistently reduced verbal and /or written language structure and vocabulary. May have a specific more severe difficulty in one modality.

4. Mild aphasia: occasional difficulties present in auditory and / or reading comprehension and in verbal and / or written expression.

5. No aphasia.

ACTIVITY LIMITATION SCALE

0. Unable to communicate in any way. No effective communication. No interaction

1. Occasionally able to make basic needs known with familiar or trained persons or trained listeners in familiar contexts. Minimal communication with maximal assistance.

2. Limited functional communication. Consistently able to make basic needs / conversation understood but is heavily dependent upon cues and context. Communicates betters with trained listener or family members or in familiar settings. Frequent repetition required. Maintains meaningful interaction related to here and now.

3. Consistently able to make needs known but can sometimes convey more information than this. Some inconsistency in unfamiliar settings.

Is less dependent for intelligibility on cues and context. Occasional repetition required. Communicates beyond here / now with familiar persons, needs some cues and prompting.

4. Can be understood most of the time by any listener despite communication irregularities. Holds conversation, requires some special consideration, particularly with a wider range of people.

5. Communicates effectively in all situations.

PARTICIPATION SCALE

0. Unable to fulfill and social/educational/family role. Not involved in decision making / no autonomy / no control over environment. No social integration.

1. Low self-confidence / poor self esteem/ upset/frustration/anger/distress/ embarrassment/concern/withdrawal teem/limited social integration/socially isolated/contributes to some basic and limited decisions. Cannot achieve potential in any situation.

2. Some self-confidence/some social integration/makes some decisions and influences control in familiar situations.

3. Some self-confidence, autonomy emerging. Makes decisions and has control of some aspects of life. Able to achieve some limited social integration/educational activities. Diffident over control over life. Needs encouragement to achieve potential.

4. Mostly confident, occasional difficulties integrating or in fulfilling social/role activity. Participating in all appropriate decisions. May have difficulty in achieving potential in some situations occasionally.

WELLBEING / DISTRESS SCALE

0. Severe constant: upset/frustration/anger/distress/ embarrassment/concern/withdrawal

1. Frequently severe: upset/frustration/anger/distress/ embarrassment/concern/withdrawal

2. Moderately consistent : upset/frustration/anger/distress/ embarrassment/concern/withdrawal

3. Moderate frequent: upset/frustration/anger/distress/ embarrassment/concern/withdrawal

4. Mild occasional: upset/frustration/anger/distress/ embarrassment/concern/withdrawal

5. No inappropriate: upset/frustration/anger/distress/ embarrassment/concern/withdrawal

6.5 Analysis

6.5.1 Mixed Methods Design

The primary method of analysis was qualitative coding of the data (Miles and Huberman, 1994) using inductive thematic coding for the decision making content and preliminary *a priori* codes developed during the pilot study for the process of decision making. A mixed methods design was used to comprehensively interrogate the verbal data also in a quantitative manner. Descriptive, non-parametric and parametric statistics were applied to the frequency of process codes data in order to study the process with a variant of the work by Jones (1989), Lamond et al. (1996b) and Twycross and Powls (2006) and explained in detail in Section 3.7.4. The statistical analysis is explained from the following section while the qualitative analysis is detailed from Section 6.5.4.

6.5.2 Ratification of Data Quality for Statistical Analysis

The quantitative data consisted of the number of times each cognitive decision making process had been used in a given verbal protocol of a given participant. The two case scenarios were designed to present an equivalent challenge but their outcomes (the quantitative data) might have differed between them. If these differences were significant then the data would be required to be analysed separately, rather than together, as it was intended. Also the outcomes could have been influenced by the order in which the case scenarios were presented to the participants. Finally, it was observed some participants took a lot longer than others to go through each case scenario and it was decided to test whether the amount of data per verbal protocol might have a difference between participants. All 26 variables (13 for each case scenario) were first tested for normality using the Shapiro-Wilks test and were found not to be normally distributed. Therefore non-parametric tests were used to test:

- whether the outcomes of the two case scenarios for a given participant differed significantly from each other (using a Wilcoxon-test);

- whether the data differed between participants by the order in which the case scenarios were presented (using a Mann-Whitney test); and
- whether the outcomes between participants differed according to the number of process strategies contained in the verbal protocols (using a Mann-Whitney test)

The results showed that in general there were no significant differences in the tests above. The final results are in Chapter 7. Two of the three differences between case scenarios where the null hypothesis had to be rejected also coincided with the variables with the lowest sample numbers. The differences around order of presentation of case scenarios affected only two variables for Case B, and in both of these the sample size was small. The null hypothesis was kept in the test for verbal protocol size. It was therefore decided that the data from both case scenarios could be analysed together.

6.5.3 Analysis of the Influence of Subject Variables

The chi-square test was used to investigate the associations between the decision making process codes found in the verbal protocols and the following extraneous subject variables:

- profession
- self- reported level of expertise
- work setting
- experience with electronic assistive technology
- experience with acquired brain injury

6.5.4 Transcription of the Verbal Protocols

All recordings were transcribed verbatim by either the researcher or a professional transcriptionist which resulted in 120 verbal protocols. Vigilant observance of confidentiality and anonymity was maintained throughout. Subsequent to verbatim transcription, each verbal protocol was checked for transcription accuracy by listening to the audio recording while reading the transcript as recommended by Easton et al., (2000). This was an essential process in ensuring that the meaning originally intended by the participant was clearly transcribed, taking into account the non-linguistic features such as intonation, pauses and humour. When such non-linguistic features had not been fully transcribed, amendments were made.

6.5.5 Segmentation of the Verbal Protocols

Once the transcription accurately reflected the think-aloud recording, each verbal protocol was read through in its entirety in order to gain a perspective on the overall content prior to segmenting and coding. Each verbal protocol in its entirety was segmented into meaningful analytical units of text.

6.5.6 Coding of the Verbal Protocols

Each verbal protocol was coded four times in order to investigate both the content and the process of decision making. Figure 6.1 illustrates the coding procedure demonstrating the four forms of coding analysis.

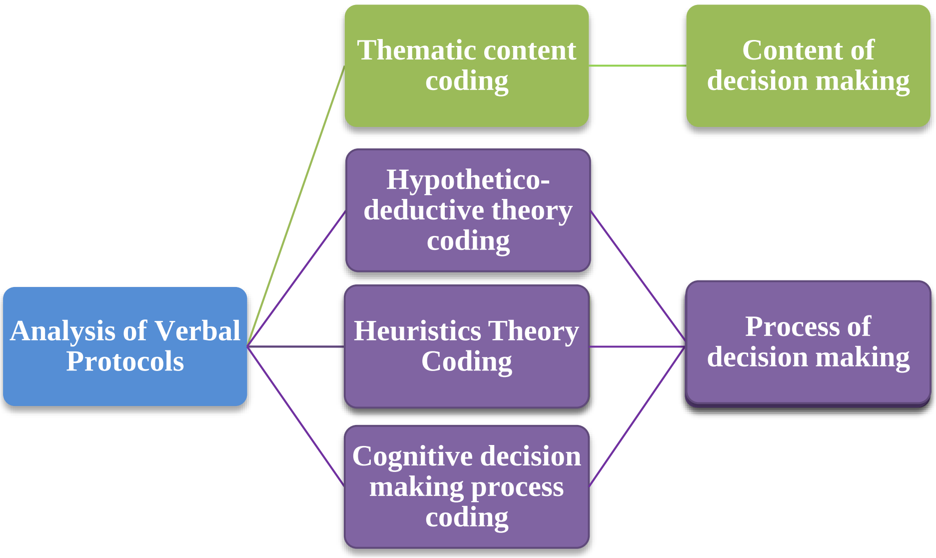


Figure 6.1: Overview of Coding Procedure for Analysis of the Verbal Protocols

6.5.6.1 Content of Decision Making Coding

In order to investigate the content of the participants' decision making, an inductive data-driven coding method was carried out on all verbal protocols (two case scenarios per participant, *n*=120) to generate thematic codes. The same procedure was undertaken as that used for the interview data in Study 1 which involved three phases of coding; analytic, categorical and descriptive.

6.5.6.2 Process of Decision Making Coding

Three forms of analysis were carried out. Two are theoretical, to examine existing models of decision making against present findings, and the third a cognitive strategies analysis, to examine decision making processes within present findings. For development and definitions of the respective codes see Chapter 3, Section 3.7.5.

i. **Hypothetico-Deductive Theory Coding**

One verbal protocol per participant (*n*=60) chosen at random was analysed using preliminary codes developed from hypothetico-deductive theory (Elstein et al., 1978). Although the preliminary codes were applied to the verbal protocols, every effort was made to remain responsive to the data.

Table 6.5: Preliminary Hypothetico-Deductive Theory Codes used During Analysis

Hypothetico-Deductive Theory Codes
Cue Acquisition
Hypothesis Generation
Cue Interpretation
Hypothesis Evaluation

ii. **Heuristics Theory Coding**

One verbal protocol per participant (*n*=60) chosen at random was analysed using preliminary codes developed from Heuristics Theory (Kahneman et al., 1982). Although the preliminary codes were applied to the verbal protocols every effort was made to remain responsive to the data. Table 6.6 lists the preliminary codes and definitions are provided in Chapter 3, section 3.9.5.

Table 6.6: Preliminary Heuristic Theory Codes used During Analysis

Heuristic Theory Codes
Anchoring & Adjustment
Availability
Representativeness

iii. **Cognitive Decision Making Process Coding**

Twelve preliminary cognitive decision making process codes were generated during the pilot study, which expanded upon previous similar research, all of which was done within the field of nursing. The preliminary codes were applied to all verbal protocols (*n*=120) while remaining watchfully responsive to the content of the data. Table 6.7 lists the preliminary codes and definitions are provided in Chapter 3, Section 3.9.8.

Table 6.7: Preliminary Cognitive Decision Making Process Codes used During Analysis

Cognitive Decision Making Process Codes
Collect
Deduce
Formulate
Discard
Interpret
Judge
Predict
Prescribe
Reason
Review
Restate
Reflect

6.6 Chapter Summary

This chapter presented the methodology for Study 2 in order to gather the data that once analysed examined both the content and the process of decision making during assessment for EAT. This complex study, used concurrent verbal protocol analysis. Standardised written case scenarios were innovatively enhanced by adding video footage of physical abilities and audio of speech abilities. The verbal protocol data was analysed using one form of quantitative statistical analysis and four forms of qualitative coding to comprehensively interrogate the data. The next chapter will present the results of this study.

Chapter 7

Results Study 2: An Investigation of the Content and Process of Clinical Decision Making during assessment for EAT

7.1 Introduction and Presentation of Findings

This chapter presents the findings from Study 2 which investigated two aspects of the participants' decision making during a think-aloud task:

- The content of the decision making;
- The cognitive processes employed to derive content.

Each aspect is reported separately.

7.2 Content of Decision Making

7.2.1 Emergence of Two Overarching Topics

Thematic content analysis of the verbal protocols, using an inductive coding method enabled two overarching themes, **Person** and **Equipment**, to emerge from the data. Each theme, contained a number of overarching **concepts** which were comprised of **topics** and **categories** generated during the coding process, which are presented as horizontal organisational charts in order to show the hierarchal nature between the different levels of coding. Figures 7.1 and 7.2 show the concepts and topics for the themes, **Person** and **Equipment** respectively.

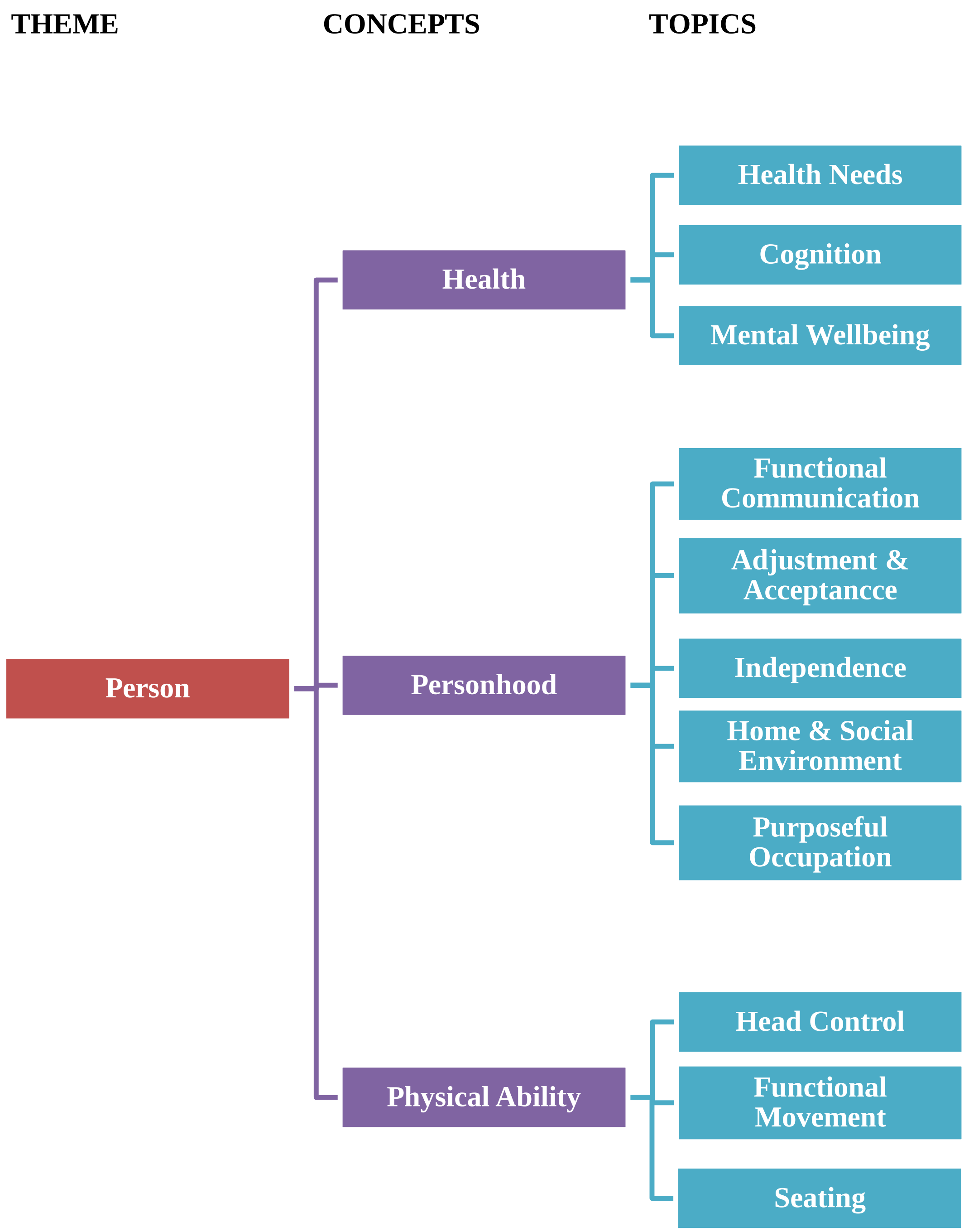


Figure 7.1: Theme - Person

This figure displays the concepts and topics for the overarching theme Person. The hierarchical character of coding is evident whereby the topic codes on the right undergo further analysis to become the three concepts of health, personhood and physical ability and subsequently, the theme Person.

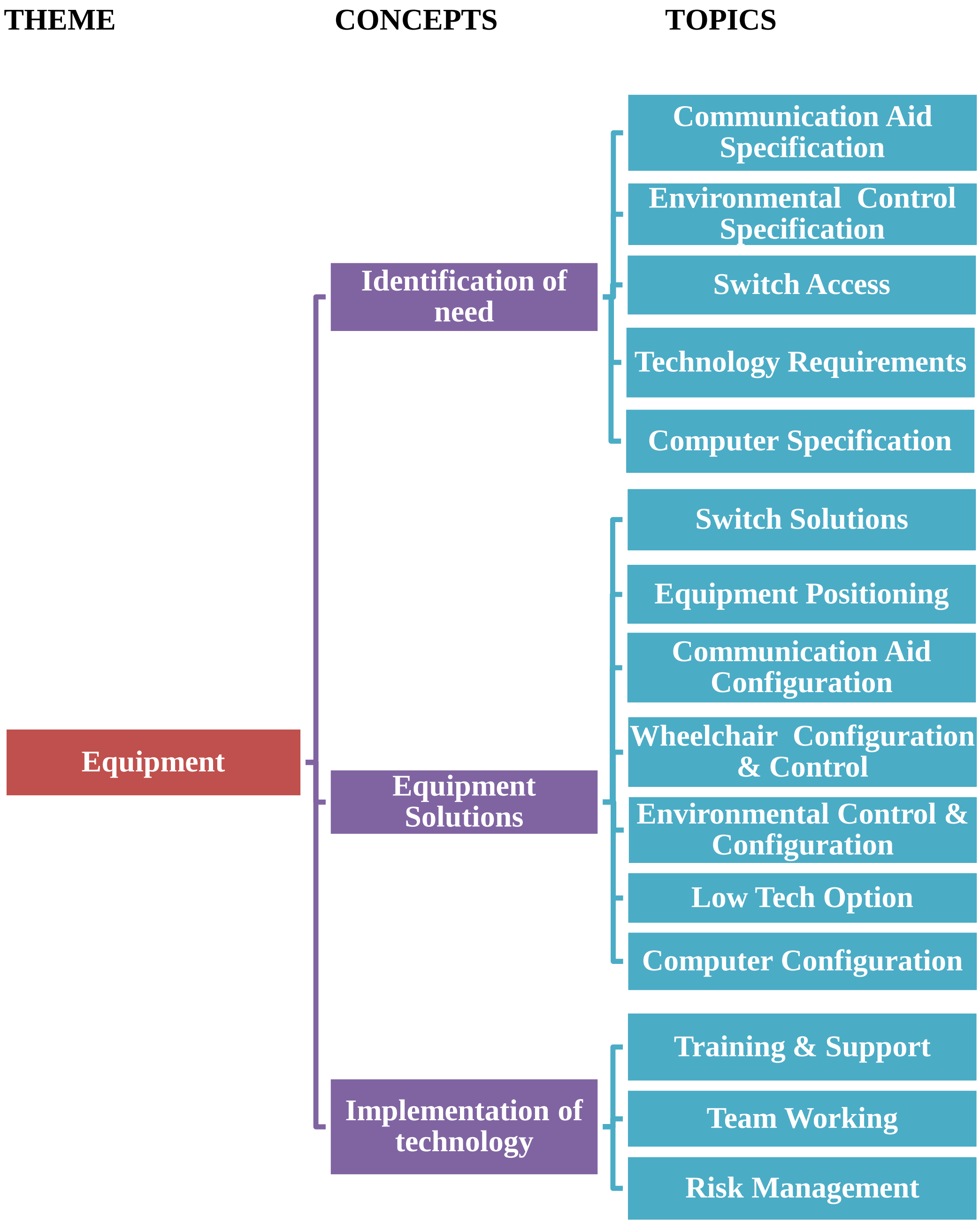


Figure 7.2: Theme - Equipment

This figure displays the concepts and topics for the overarching theme Equipment. The hierarchical character of coding is evident whereby the topic codes on the right undergo further analysis to become the three concepts of identification of need, equipment solutions and implementation and subsequently, the theme Equipment.

7.2.2 Presentation of Results

Results from each **Theme** are reported separately, starting with **Person** followed by **Equipment**. The results are reported by **concept, topic**, and **category** in the order presented in the flowchart detailed at the beginning of each section. The flowcharts were constructed based upon the frequency occurrence of each category derived from the data.

The total number of participants reporting each topic and category is included as n=xP and the total number of statements coded in the data is given as xS. As there were two case scenarios it is possible that the total number of participants generating a code could be n = 120 P if all participants generated the same code. Examples of verbatim statements from the data are presented in a box at the end of each category section with the participant number and profession.

7.2.3 Theme 1: Person

7.2.3.1 Concept 1: Health

This Concept is comprised of three topics and nine categories. The concept Health is defined as the user's physical health, cognitive abilities and psychological wellbeing.

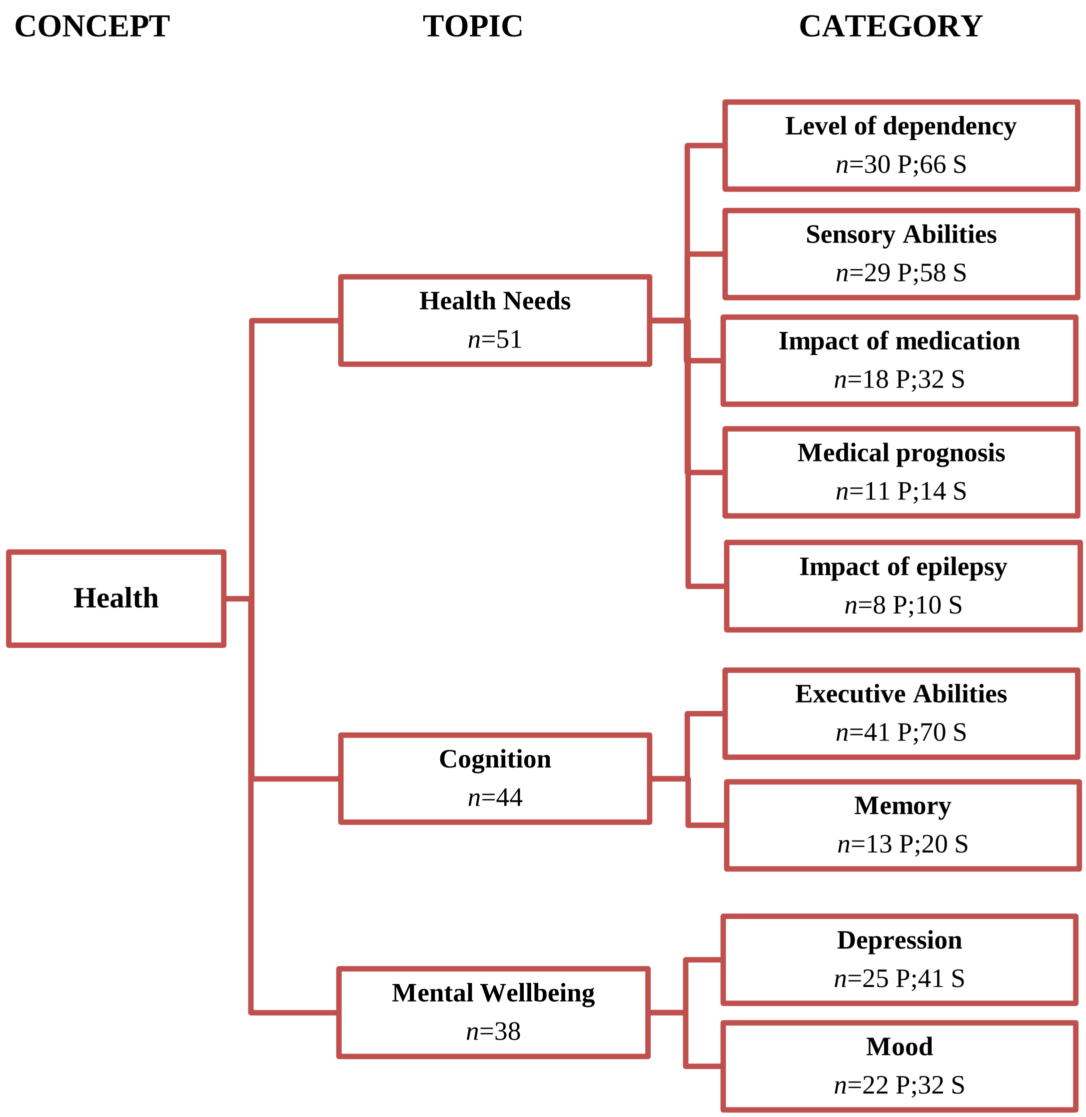


Figure 7.3: Concept 1: Health

The concept, topics and categories derived from thematic content analysis of the verbal protocols.

Topic 1: Health Needs

The topic **Health Needs** is defined as the individual's level of morbidity and the impact of concomitant disorders upon their life in relation to the use of EAT.

Of the five categories identified, the individual's **level of dependency** and **sensory abilities,** were raised by all professions. Sixty percent of BEs (*n*=12) and 55% of SLTs (*n*=11) considered **level of dependency** in comparison to 35% of OTs (*n*=7). However, while the number of statements generated were similar across the professions, the results indicate that although fewer OTs raised the issue they addressed it in greater detail (BE, s=22; OT, s=20; SLT, s=24). The key aspects which were considered across the professions were the burden of care, the need for a comprehensive care package, the role of technology in relation to safety when alone, the variability in staff's skills and knowledge and the role of the carers.

Extract: "*He would never be out anywhere independently, anyway. He may want to go somewhere with his friends and leave the carer at a distance. I think his carers are going to be really important.*" 38, SLT

Sensory abilities, in particular vision, were also identified as important by all professions. Fewer BEs than OTs and SLTs raised it (BE, *n*=6, 30%; OT, *n*=11, 55%; SLT, *n*=12, 60%) although the number of statements provided per participant was very similar (BE, s=14; OT, s=24; SLT, s=21). The BEs focused exclusively on how to access the technology by using adaptive interface devices (switches) or eye gaze whereas the therapists also talked about the perceptual implications of the visual difficulties.

Extract: *"Check if there is any perceptual stuff there looking… I need to look at the size of fonts or pictures, whatever, coloured backgrounds and how many things on a page and how she copes with stuff like that."* 17, OT

The **impact of medication** for treating spasticity was considered primarily by the BEs (*n*=10, 50%; s=17) and its effect on attention and alertness by the SLTs (*n*=6, 30%; s=13) with few OTs (*n*=2, 10%; s=2) considering it.

Extract: "*Do they cause her to be particularly woozy or tired or something at particular times of day and would we be looking at using the same device or something different for those times."* 39, SLT

The user's **medical prognosis** was considered by 25% or fewer participants from each profession (BE, *n*=4, 20%, s=5; OT, *n*=2, 10%, s=3; SLT, *n*=5, 25%, s=6). The main issue addressed by all professions was the potential for further improvement in relation to the prescription and implementation of EAT.

Extract: *"..so a lot of her primary recovery will have been done, but there is still a lot of chance for her to make further recovery."* 50, SLT

The **impact of epilepsy** in relation to levels of arousal and ability to learn was considered by few participants (BE, *n*=3, 15%, s=3; OT, *n*=1, 5%, s=1; SLT, *n*=4, 20%, s=6).

Extract: *"what's triggering it? Is it coming under control and how does it make him feel and what's the nature of it?"* , 24, SLT

Topic 2: Cognition

The topic **cognition** is defined as a number of cerebral processes specifically, the ability to learn, attention, information processing, initiation, memory and problem-solving. Forty-four (73%) participants commented on one or more aspects of cognition and similar issues were raised by all professions. However, the OTs raised more aspects of cognition more frequently than the other professions (BE, *n*=14, 70%; s= 26; OT, *n*=17, 85%; s=45; SLT, *n*=13, 65%; s=18).

The importance of the **executive abilities** in relation to identifying and prescribing an appropriate device was raised by more OTs than BEs or SLTs (BE, *n*=14, 70%, s=25; OT, *n*=16, 80%, s=33; SLT, *n*=11, 55%, s=12). The key aspect considered by all professions was the ability to understand and engage with complex tasks. The BEs and the OTs focused on task complexity, specifically in relation to the design and layout of the device and ability to use row-column scanning and submenus. The OTs considered the participant's cognitive abilities in relation to their everyday functioning and their level of independence which they then employed to make decisions about identifying and implementing an EC system or communication device. Attention and concentration and the ability to learn were also reported primarily by the OTs. The impact of the individual's degree of awareness and insight into their condition in relation to implementation of EAT was considered by SLTs and one BE talked about cognitive status in relation to safety issues and the ability to interrogate callers via the door entry system. The user's **memory** function was reported by the OTs in greatest number (*n*=13; BE, *n*=2, 10%, s=2; OT, *n*=7, 35%, s=12; SLT, *n*=4, 20%, s=6) and all professions considered the impact of memory difficulties upon learning how to use technology.

> **Extract:** *"In terms of the complexity of the units, it would probably be best to start off with something relatively simple and see how she managed and then maybe progress to something more complex once we understood what her cognitive ability was, really, in terms of how complex a system she can cope with."* 55, BE

Topic 3: Mental Wellbeing

The topic **mental wellbeing** as used within this study refers to the user's mental health and the effect of such upon the prescription of EAT. Sixty-three percent (*n*=38) of participants reflected upon the issue of mental wellbeing, of which 45% (*n*=17) were SLTs (BE, *n*=8, 40%; OT, *n*=13, 65%; SLT, *n*= 17, 85%). However, the number of statements produced per participant were similar across the professions (BE, s=14; OT, s=24; SLT, s=35).

Depression was discussed primarily by the OTs and SLTs (BE, *n*=3, 15%; OT, *n*=12, 60%; SLT, *n*=11, 55%) and in greater detail by the SLTs (BE, s=5; OT, s=15; SLT, s=21). All professions emphasised the impact of depression upon motivation to communicate and engage with EAT. The OTs also reflected on the cause of the depression and suggested that it may be a reactive depression, exacerbated by the long rehabilitation process.

> **Extract:** "*It concerns me; … no prior medical history of depression, but we've got depression now. Very, very common. She's lost all of her functional roles as a Mum."* 61, OT

The impact of the user's **mood** and possible mood swings was considered by less than 50% of the BEs and OTs (BE, *n*=6, 30%; OT, *n*=4, 20%) in comparison to 60% of the SLTs (*n*=12) although the OTs talked about it in greater detail (BE, s=9; OT, s=9; SLT, s=14). All professions discussed how mood may affect acceptance of EAT and the importance of considering mood swings when positioning the aid. The durability of the equipment was also taken into consideration by SLTs.

Extract: "*he might only use it as a weapon* " 58, BE

7.2.3.2 **Concept 2: Personhood**

This concept is comprised of five topics and fifteen categories. The use of personhood in this study corresponds with the principles of the Person-Environment-Occupation Model (Law et al., 1996) which recognises the dynamic interrelationship between the multiplicity of roles which an individual may occupy, their cultural, social and physical environment and their purposeful activities. This concept was therefore generated from codes which were related to such issues and Figure 7.4 shows the codes generated by an inductive coding process.

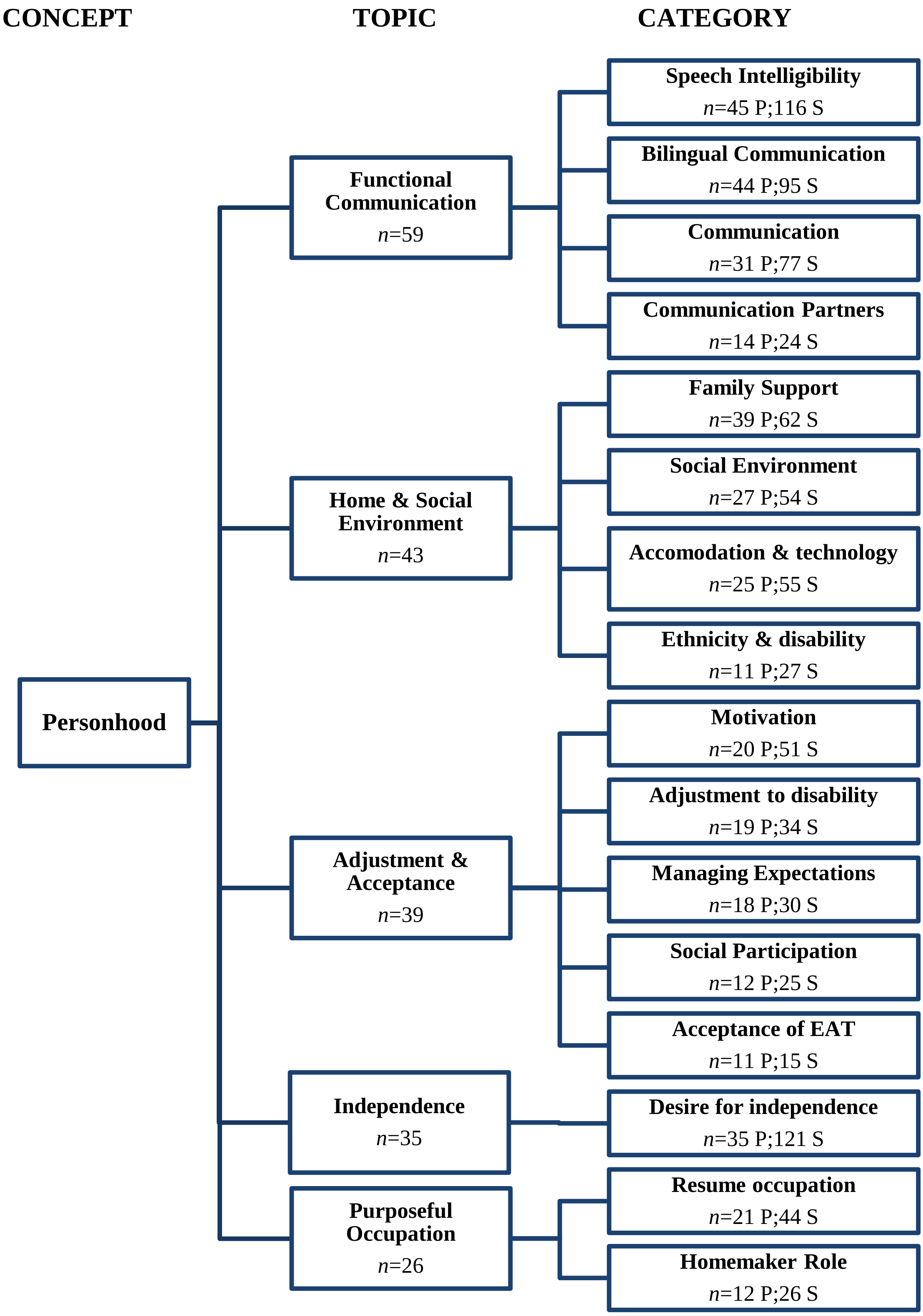


Figure 7.4: Concept 2: Personhood

The concept, topics and categories derived from thematic content analysis of the verbal protocols.

Topic 1: Functional Communication

The topic **Functional Communication** is defined as the individual’s ability to get their message across in an everyday setting. They may use speech or a combination of methods including low- and high-tech AAC. Ninety-eight percent (*n*=59) of participants considered communication in the everyday context (BE, *n*=19, 95%; OT, *n*=20, 100%; SLT, *n*=20, 100%) with the SLTs producing almost twice as many statements than the BEs and OTs (BE, s=79; OT, s=80; SLT, s=153).

The user’s **speech intelligibility** was raised by all professions (BE, *n*=18, 90%; OT, *n*=14, 70%; SLT, *n*=13, 65%) and in most detail by BEs (BE, s=47; OT, s=29; SLT, s=40). There was a marked difference between the participants’ attitude towards the intelligibility of the users’ speech with the BEs and OTs commenting upon the degree of difficulty in understanding and suggested that everyone, apart from family, would also find it extremely hard to understand. It was suggested that maybe speech could be used within the home but it would be time consuming to understand. The OTs suggested that there may be problems with the carers’ understanding of speech. The SLTs tended to take a different perspective on speech intelligibility; instead of perceiving it negatively they were also interested in the functional use of speech and the potential for improvement.

Extract: *That’s still positive, then. He can get single words across.”* 39, SLT

The presence of more than one language within the family environment and the user's **bilingual communication** skills was considered by all professions, predominately by the SLTs (BE, *n*=13, 65%; OT, *n*=14, 70%; SLT, *n*=17, 85%) who also considered it in greatest detail (BE, s=20; OT, s=28; SLT, s=47). The issues raised were similar for all professions with the focus upon the language spoken at home, which was assumed to be English, and the implication of being able to communicate in other languages in order to maintain social interaction and potentially status.

> **Extract:** *"It might be that the older network is possibly the people that are going to be most challenging to communicate with and possibly the most motivating for her to in terms of her maintaining her status"*. 45, BE

The ability to use speech for **everyday communication** was addressed by fewer BEs than OTs and SLTs (BE, *n*=5, 25%; OT, *n*=12, 60%; SLT, *n*=14, 70%) with SLTs providing the most information (BE, s=10; OT, s=18; SLT, s=49). The BEs considered how the user could use speech to communicate their basic needs and say yes and no whereas the OTs and SLTs were interested in encouraging functional speech, training for friends and developing cueing strategies to enable the listener to understand. It was felt that they could use their speech with family and familiar partners and with others when the conversational context was known. The SLTs analysed the speech in order to suggest strategies and techniques which could assist with increasing intelligibility.

Extract: "*It seems a waste to have a guy who can actually say a couple of things when he's not fatigued and not do something with it … work on his phrasing in a meaningful way.*" 16, SLT

The environments in which the user is communicating, their **communication partners** and how to repair the conversation in the event of breakdown were considered primarily by the SLTs (BE, *n*=2, 10%; s=2; OT, *n*=3, 15%; s=5; SLT, *n*=9, 45%; s=17). The need to provide support and training for the communication partners was also raised.

Extract: *"teaching dad and family about ways to interact and thinking about how they can communicate and what they are saying and things they can listen for and how they can slow down and support her in her communication"* 44, OT

Topic 2: Home and Social Environment

The topic **home and social environment** was defined as the context and situation within which the individual functions. Seventy-two percent (*n*=43) of participants considered the impact of the environment, the majority of whom were BEs (BE, *n*=17, 85%; OT, *n*=13, 65%; SLT, *n*=13, 65%) although a similar degree of detail was produced by all professions (BE, s=87; OT, s=51; SLT, s=60).

The presence and influence of **family support** was raised predominately by the BEs (BE, *n*=16, 80%; OT, *n*=13, 65%; SLT, *n*=10, 50%) with similar detail provided across the professions (BE, s=22; OT, s=22; SLT, s=18). The role of the family members, their availability and willingness to assist with using technology and the provision of a supportive environment were considered by all professions.

Extract: *"the carer situation and the family and everybody around them have to influence our decision."* 35, BE

The **social environment** was considered by fewer OTs than BEs or SLTs (BE, *n*=9, 45%; OT, *n*=7, 35%; SLT, *n*=11, 55%) and in less detail (BE, s=23; OT, s=7; SLT, s=24). All professions commented upon family life and the relationship between the social environment and the resultant head injury in Case A. The SLTs also considered the impact of housing in relation to opportunities for communication.

Extract: *"what's his social environment going to be, because I can see him being stuck with an out of order lift in a high rise flat and no-one to talk to."* 22, SLT

The main considerations raised by all professions in relation to **accommodation and technology** were the use of technology within the home and home adaptations. A similar number of BEs and OTs reported on these issues with fewer SLTs (BE, *n*=10, 50%; OT, *n*=9, 45%; SLT, *n*=6, 30%) although the SLTs provided the greater detail (BE, s=22; OT, s=18; SLT, s=15). The BEs and OTs discussed physical access to and within the home and Participant 18, OT commented

Extract: "*Home layout is going to be impeccably important"* 18, OT

The potential relationship between **ethnicity and disability** was considered by a few participants per profession with more BEs than OTs and SLTs (BE, *n*=5, 25%; OT, *n*=3, 15%; SLT, *n*=3, 15%). The BEs also provided approximately four times more detail than the OTs and SLTs. (BE, s=20; OT, s=4; SLT, s=3).

The concept and acceptance of disability and role adjustment were raised by all professions as is evident in the comment by Participant 6, OT

Extract: "*there might be different family dynamics going on, because of Asian culture and actually attitudes, well not attitudes, but how they cope with disability within a family setting.*" 6, OT

Topic 3: Adjustment & Acceptance

The topic **adjustment and acceptance** was defined as the process of adapting to life subsequent to a brain injury and recognition of the need for EAT. Sixty-five percent (*n*=39) of participants considered these aspects, the majority of whom were SLTs (BE, *n*=10, 50%; OT, *n*=13, 65%; SLT, *n*=16, 80%) and who also reported in the greatest detail (BE, s=42; OT, s=31; SLT, s=82).

Motivation was considered by all professions (BE, *n*=5, 25%; OT, *n*=7, 35%; SLT, *n*=8, 40%) with the BEs and SLTs providing greater detail than the OTs (BE, s=15; OT, s=11; SLT, s=25). All professions considered the relationship between motivation and use of EAT in addition to the impact of depression upon motivation. The BEs suggested that it was important to introduce technology which would be motivating to use, such as being able to listen to music. The OTs main concern was general motivation and how the implementation of EAT may assist with improved control. The SLTs were interested in environments which were motivating and were aware of the motivation required to use switch access.

Extract: "*…it's asking a lot to ask someone to use a switch to access communication. You need to be really, really motivated.*" 13, SLT

Psychological acceptance and adjustment were raised as issues in relation to the user's **adjustment to disability** by all professions. Fewer BEs and OTs than SLTs (BE, *n*=5, 25%; OT, *n*=4, 20%; SLT, *n*=10, 50%) commented upon adjustment and SLTs provided the greatest detail (BE, s=6; OT, s=7; SLT, n=21). All professions considered the timescale involved in the adjustment process and the SLTs considered the emotional implications of going home.

Extract: *"his communication …could be very difficult for him to imagine since he's probably still grieving quite a lot"* 45, BE

An equal number of participants from each profession (BE, *n*=6, 30%; OT, *n*=6, 30%; SLT, *n*=6, 30%) talked about the importance of **managing expectations** in similar detail (BE, s=10; OT, s=8; SLT, s=12). All professions mentioned the need to manage expectations in relation to the use and speed of technology and scanning in particular and the relative slowness of such. The SLTs also considered the importance of managing expectations in regard to spoken communication and the potential for further improvement.

Extract: "*I think there is an issue about managing expectations in this one. If she has expectations about resuming the duties, what level of duties she anticipates resuming,"* 59, BE

Social participation was discussed by few participants per profession (BE, *n*=4, 20%; OT, *n*=2, 10%; SLT, *n*=6, 30%) and the SLTs provided the greatest depth of information (BE, s=6; OT, s=3; SLT, s=16). The main issue raised by all professions was the need to maintain social and leisure activities and the BEs talked about the likelihood of losing friendships.

Extract: "*we need a way to help him maintain his social network."* 38, SLT

The **acceptance of EAT** was raised by 30% or fewer of the participants per profession and the level of detail provided was similar across professions (BE, *n*=3, 15%; s=5; OT, *n*=2, 10%; s=2; SLT, *n*=6, 30%; s=8). All professions recommended that the user's opinion regarding the appearance was important to acceptance of the technology and the SLTs mentioned the need for the device to have "street cred." The BEs were primarily concerned regarding the motivation to use and acceptance of EAT. The psychological reaction to having a synthetic or synthesized voice that was not the individual's own was raised by SLTs.

Extract: "*But I think the young man, he's only 18 and he's going to have big issues about acceptance of assistive technology in any way, shape or form. Lots and lots and lots of resistance to change, I think.*" 60, BE

Topic 4: Independence

The topic **independence** was defined as the ability to be physically autonomous and was reported by 65% (*n*=35) of participants.

The likelihood of and the **desire for independence** was reported by all professions and was raised by twice the number of SLTs than BEs (BE, *n*=7, 35%; OT, *n*=13, 65%; SLT, *n*=15, 75%). The detail provided was similar across the professions (BE, s=27; OT, s=44; SLT, s=50). The BEs and SLTs concentrated upon the use of technology inside and outside the home to enable increased independence. The OTs spoke in less detail about the technology and considered the emotional consequences of increased independence. Additionally, acknowledging the user's long term aims and their technology preferences were perceived as important in facilitating the process of independence. There was also a focus on the need to maintain their pre-morbid lifestyle and try to normalise the situation in order to decrease the potential for learned dependency.

Extract: "*an intercom possibly in the house, so she could open the door ….. because then she'd have a good feeling of independence and she can control who comes in and who goes out.*" 49, BE

The topic **purposeful occupation** was defined as activities of daily living which have been selected as a result of personal preference, personal goals, and needs. Thirty-five percent (*n*=26) of participants considered this topic with a similar number of OTs and SLTs and the fewest BEs (BE, *n*=7, 35%; OT, *n*=9, 45%; SLT, *n*=10, 50%). The OTs provided the greatest detail (BE, s=19; OT, s=30; SLT, s=21).

The possibility of the users' **resuming their occupation** was raised by between 30-40% of participants per profession with similar depth of detail provided (BE, *n*=6, 30%; s= 15; OT, *n*=8, 40%; s= 16; SLT, *n*=7, 35%; s= 13). The return to education was considered feasible by all professions and the BEs and SLTs focused primarily upon the technology required for learning whereas the OTs were concerned with the change in long-term plans. Return to work was not considered likely and no recommendations were made in this regard.

Extract: "*the implications of somebody who was previously physically quite fit and what that means in terms of his life goals"* 19, OT

Enabling the user to resume her **homemaker role** was addressed by few participants, the majority of whom were OTs, who also considered it in greater detail than BEs and SLTs (BE, *n*=2, 10%; s= 4; OT, *n*=6, 30%; s= 14; SLT, *n*=4, 20%; s= 8). The OTs and SLTs were keen that she could manage the household practically, whether in a hands-on or supervisory capacity. The SLTs focused on the engagement with her children and the BEs considered how she could re-establish her central role within the family to a satisfactory level.

Extract: "*I suspect she's going to be looking for ways that she can interact with them, maybe not in the way that she did beforehand, but in a way that's effective for her to still maintain some of that parent role, even if she can't carry all of that parent role out any more."* 50, SLT

7.2.3.3 **Concept 3: Physical Abilities**

This concept is comprised of three topics and seven categories. The concept Physical Abilities is defined as the individual's functional range, speed and strength of movement.

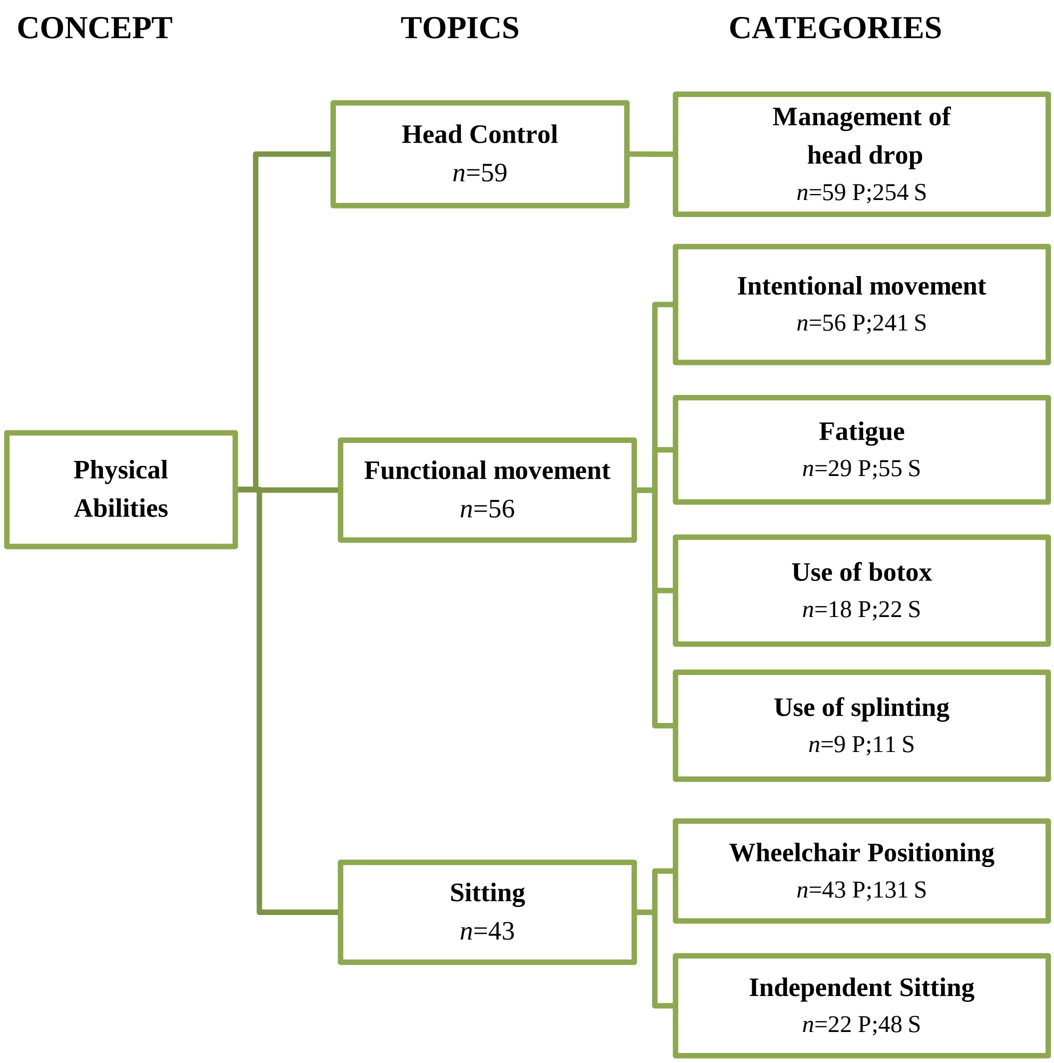


Figure 7.5: Concept 3: Physical Abilities

The concept, topics and categories derived from thematic content analysis of the verbal protocols.

Topic 1: Head Control

Head control was defined as the ability to maintain the head in any position of choice. Ninety-eight percent (*n*=59) of participants discussed this topic (BE, *n*=19, 95%; OT, *n*=20, 100%; SLT, *n*=20, 100%) and SLTs provided the greatest detail (BE, s=62; OT, s=87; SLT, s=105).

The **management of head drop** was raised by 100% of OTs and 98% of the BEs and SLTs and discussed in the greatest detail by the SLTs (BE, *n*=19, 95%; s= 62; OT, *n*=20, 100%; s= 87; SLT, *n*=19, 95%; s= 105). All professions considered alternative methods of managing frequent head dropping and suggested tilting of the wheelchair, improved positioning, head supports and straps. Additionally, the BEs focused upon managing head control for switch access, the OTs recommended a seating review and the SLTs discussed the impact of lack of eye contact during communication and difficulty with using technology.

> **Extract:** "*that's really going to have an impact on his communication as well as what he sees and what he's accessing."* 44, SLT

Topic 2: Functional Movement

Functional movement was defined as the user's ability to achieve intentional and purposeful movements. It was reported by 93% (*n*= 56) of participants and by all the OTs and 90% of BEs and SLTs (BE, *n*=18, 90%; OT, *n*=20, 100%; SLT, *n*=18, 90%). The OTs provided the greatest detail (BE, s=104; OT, s=134; SLT, s=91).

Movement was discussed by all OTs and 90% of BEs and SLTs (BE, *n*=18, 90%; OT, *n*=20, 100%; SLT, *n*=18, 90%) The OTs considered it in greater detail than the other professions (BE, s= 75; OT, s= 93; SLT, s= 73). They considered the range and control of movement, the implication for seating, the use of splints and the functional usage of the users' head, upper and lower limbs. Functional usage and the impact upon muscle tone was only addressed by the OTs. The BEs and SLTs focused their attention on how each user could use their movements in a functional manner and the physical effort of maintaining postural control upon fatigue levels.

Extract: *"I don't think we are going to get anything that's useful that's not going to compromise spasms and increase tone and things like that"* 3, OT

The impact and management of **fatigue** was considered by 40% of BEs and SLTs and 65% of OTs (BE, *n*=8, 40%; OT, *n*=13, 65%; SLT, *n*=8, 40%) with the BEs and OTs discussing it in similar detail (BE, s= 16; OT, s= 26; SLT, s= 13). The main issue for all professions was the selection and tolerance of methods of switch access. Factors impacting upon such included the variability in fatigue throughout the day and the resultant need to prescribe different access methods. The OTs also talked about the likelihood of persistent tiredness given that switch access was essential. They also considered the systemic effect of fatigue and how it impacted upon other functions.

Extract: *"To hold a conversation takes time and energy. If he fatigues after ten minutes then what allowances are made to allow him to do that"* 18, OT

Thirty-five percent of BEs and OTs and 20% of SLTs discussed the **use of botox** with similar level of detail provided by all professions (BE, *n*=7, 35%, s=10; OT, *n*=7, 35%, s=8; SLT, *n*=4, 20%, s=4). All professions talked about the effect of botox on enabling functional movement in relation to EAT and specifically switch access. The challenges of using botox were also addressed.

Extract: *"she will go from being quite tight to possibly being able to use it, but only for a certain length of time which causes some problems for us, functionally"* 34, OT

The need for and potential usefulness of wrist **splinting** was discussed by 30% of OTs in contrast to 10% of BEs and 5% of SLTs (BE, *n*=2, 10%, s=3; OT, *n*=6, 30%, s=7; SLT, *n*=1, 5%, s=1). The OTs also recommended a splinting review and alternatives to plastic splints should they not be tolerated.

Topic 3: Sitting

Seventy-two percent (*n*=43) of participants considered **sitting** with the greatest number of OTs (BE,*n*=14, 70%; OT, *n*=18, 90%; SLT, *n*=11, 55%) raising it and providing the greatest detail (BE, s=64; OT, s=76; SLT, s=39).

The importance of **wheelchair positioning** was raised by almost all the OTs (90%) in contrast to 50% of SLTs and 75% of BEs who addressed this issue. All professions talked about it in similar detail although the BEs addressed the widest range of issues (BE, *n*=15, 75%, s=49; OT, *n*=18, 90%, s=51; SLT, *n*=10, 50%, s=31). All professions talked about the influence of positioning on the use of electronic assistive technology, how positioning should be the starting point of any prescription, the need to ensure that sitting balance is optimal and the individual has the correct supports. The BEs and OTs were specific in their seating recommendations and recommended specific tilt angles in order to manage the head drop whereas the SLTs only suggested that tilting would be necessary. The SLTs also recommended securing advice from the OT regarding general positioning and postural management in order to avoid pressure sores. The BEs considered the impact of fatigue, the user's postural priorities, use of a harness and lateral supports upon wheelchair positioning and suggested that a detailed postural assessment was required. The OTs talked about the importance of footplates in addition to the necessity of teaching the user's family and carers about the importance of positioning.

> **Extract:** *"The main thing really is to make sure he's well seated and let people [know] when he's back home or wherever, the importance of positioning. Maybe physio or wheelchair services to be advising on that."* 33, OT

Over half of the OTs (60%) raised the prospect of **independent sitting** in contrast to 15% of the SLTs and 35% of BEs (BE, *n*=7, 35%, s=15; OT, *n*=12, 60%, s=25; SLT, *n*=3, 15%, s=8). A similar amount of detail was provided by all professions (BE, s=15; OT, s=25; SLT, s=8) although the OTs and BEs addressed a wider range of issues. All professions talked about pressure-relief-supported seating and the OTs and SLTs considered seating in different chairs throughout the house. The OTs also reported on the need to manage sitting tolerance. The BEs provided information about creating bespoke equipment and the need to liaise with specialists.

7.2.4 **Theme 2: Equipment**

7.2.4.1 **Concept 4: Identification of needs**

This concept is comprised of five topics and seventeen categories and is defined as the collation of information regarding the user's bespoke need for EAT.

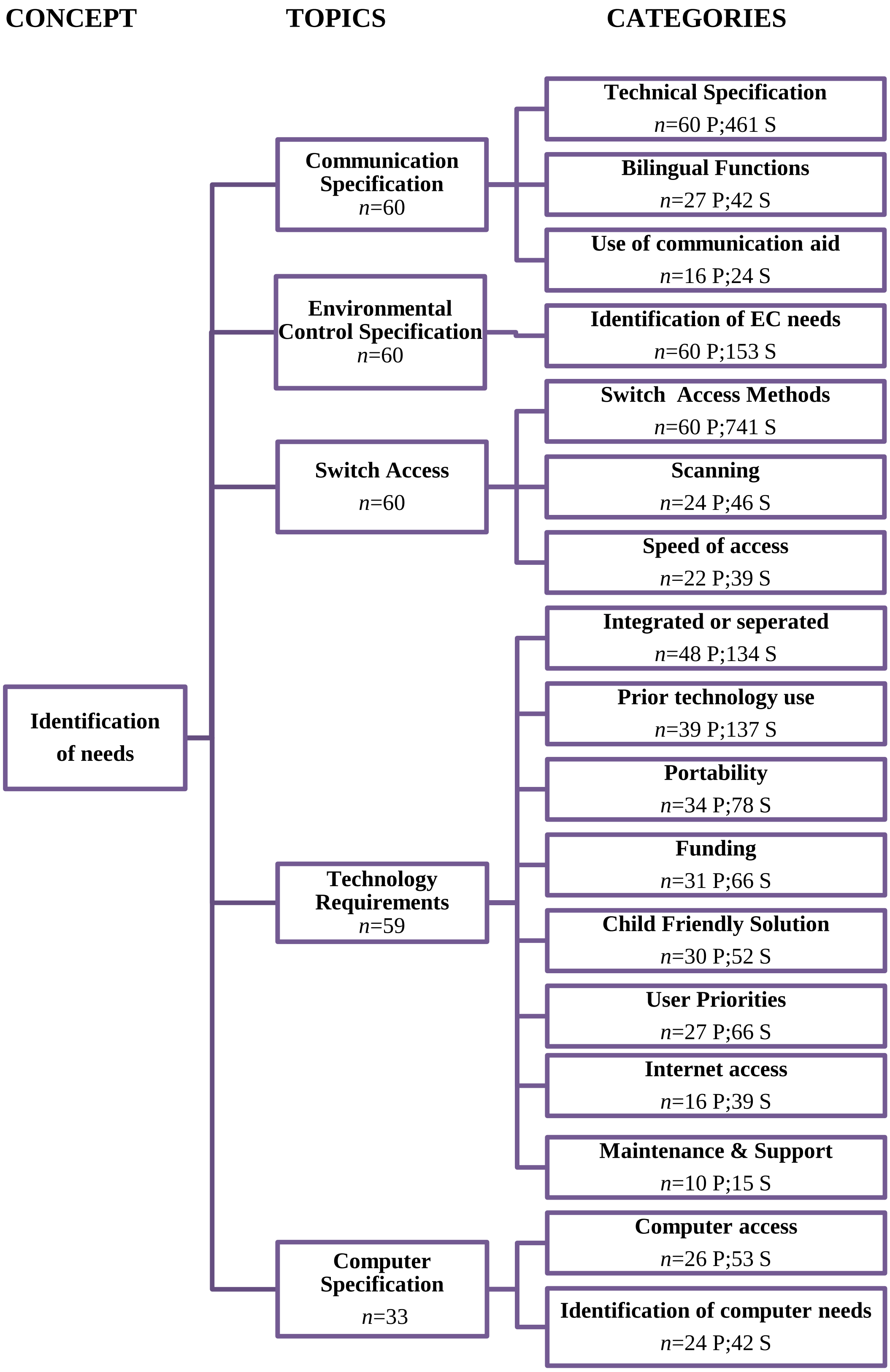


Figure 7.6: Concept 4: Identification of Needs

Thematic content analysis of responses illustrating the concept, topics and categories derived from the data.

Topic 1: Communication Aid Specification

This code was defined as the user's bespoke technical and non-technical requirements necessary for optimal configuration of the communication device. All participants (*n*=60, 100%; BE, *n*=20, 100%; OT, *n*=20, 100%; SLT, *n*=20, 100%) discussed the communication aid specification and the SLTs provided the greatest detail (BE, s=184; OT, s=127; SLT, s=216).

All participants detailed the **technical specification** of the communication aid and the SLTs provided the greatest detail and the OTs the least (BE, *n*=20, 100%, s=164; OT, *n*=20, 100%, s=111; SLT, *n*=20, 100%, s=186). All professions agreed that a voice output communication aid was required as the users' speech was unintelligible to strangers and OTs took into consideration the age of the children in case B. The advantages and disadvantages of synthesised and digitised speech were raised in relation to adding specific phrases recorded by family members. Synthesised speech was preferred by all professions and the SLTs suggested that it would be helpful if the voice was culturally appropriate.

The possibility of using a tablet or laptop computer loaded with specialised communication software was considered by all professions and the BEs considered this would increase the speed of implementation. It was perceived that if the user could load communication software onto an existing computer that would be a much faster solution than the provision of a dedicated communication aid. An additional consideration was in relation to familiarity and it was suggested that the user's pre-morbid use of a computer may make it easier to relearn and therefore use more easily. The SLTs also advocated the use of a dedicated communication aid with computer functionality in order to ensure a comprehensive system.

The BEs and SLTs also considered the technical requirements of the equipment such as the need for robustness, the use of the wheelchair battery to power the aid and the need to ensure that the equipment were future proof. They also took into consideration the possibility of use within an education environment in the future and the technical implications thereof. The usefulness of an embedded phone facility was suggested as the users' family were geographically widespread. The OTs and SLTs specified that the aid should be appropriate for a literate user in order to enable them to generate novel utterances and not be confined to pre-stored words and phrases.

Extract:

"if he has got normal reading ability and normal ability to produce text as well in terms of literacy, then, I would be looking at a computer-based communication system." 50, SLT

Ensuring that the communication aid had **bilingual functionality** was considered by a similar number of participants from each profession with the greatest detail provided by the SLTs (BE, *n*=8, 40%, s=8; OT, *n*=10, 50%, s=16; SLT, *n*=9, 45%, s=18). The issues raised were the same across the professions. All professions mentioned the possibility of using the device's computer functionality to access the internet in order to use an online translation programme. The potential difficulties with accurate translation were recognised by all. The issue of a digitised or synthesised voice was also raised in relation to storage or generation of non-English phrases by all professions. The SLTs considered the future expansion of the communication aid in relation to the availability of bilingual communication software.

Fifty percent of BEs and 30% of SLTs spoke about the perceived **use of the communication aid**. No OT raised this issue and the SLTs considered it in the greatest detail (BE, *n*=10, 50%, s=12; OT, *n*=0, 0%, s=0; SLT, *n*=6, 30%, s=12). The BEs suggested that although an aid was required, it was likely to be either underused or abandoned if there was not sufficient support. The SLTs focused upon the user's purposeful selective use of an aid and took such into consideration during their assessment. The availability of family support and the effectiveness of the aid were highlighted as of key importance in ensuring use.

Extract: *"simple to programme and change over time ...to ensure that it's being used and not left in a cupboard. I would imagine with his mood swings he can't be bothered and his family won't bother and no-one will bother"*. 58, BE

Topic 2: Environmental Control Specification

This code was defined as the user's bespoke technical and non-technical requirements necessary for optimal configuration of the environmental control system. All participants (*n*=60, 100%; BE, *n*=20, 100%; OT, *n*=20, 100%; SLT, *n*=20, 100%) discussed the specification. A similar amount of detail was provided by the BEs and OTs with the least provided by the SLTs (BE, s=57; OT, s=64; SLT, s=32).

The **identification of EC needs** was undertaken by all participants with the OTs discussing it in greatest detail and the SLTs the least (BE, *n*=20, 100%, s=57; OT, *n*=20, 100%, s=64; SLT, *n*=20, 100%, s=32). Although there were similarities between the professions, there were also distinct differences in focus. All professions reported on the need for the user to be able to control entry to the house and the attendant risks were taken into consideration. The need to refer for a specific EC assessment was also raised by all professions.

The BEs concentrated upon the EC technical and safety features and ease of use whereas the OTs and SLTs focused upon aspects which would promote independence and self-esteem. Features such as carer alerts, an emergency call system and pre-stored phrases which could be used to call for help were identified as essential by the BEs. The OTs and SLTs concentrated upon promoting independence within the home by enabling the user to control the TV, audio system, curtains and lights.

Extract: *"the danger might be that the children start doing everything for her."* 37, OT

Topic 3: Switch Access

This code was defined as the identification of switch technology which would provide access to the communication aid and ECS by operating as an interface between the user and the device. All participants (*n*=60, 100%; BE, *n*=20, 100%; OT, *n*=20, 100%; SLT, *n*=20, 100%) raised the need for switch access and a similar amount of detail was provided by the BEs and SLTs with the greatest detail provided by the OTs (BE, s=266; OT, s=295; SLT, s=265)

All participants considered methods by which the users would physically access the equipment (BE, *n*=20, 100%; OT, *n*=20, 100%; SLT, *n*=20, 100%). A wide range of **switch access methods** were suggested and the OTs provided the greatest detail (BE, s=232; OT, s=271; SLT, s=238). Identifying a physical movement which could be repeated with accuracy and without fatigue was raised by all professions as a potential site for placing a switch. All professions considered using head movement, eye blink, eye gaze, a suck / puff system, voice control, shoulder, elbow, hand and finger movement in addition to an EMG switch to capture nerve impulse control movement. The advantages and disadvantages of each, including the practical set-up of the switch and the need to train carers regarding precise location were raised by all professions. Identifying a straightforward method was also mentioned by all professions. Using two switches to speed up access was suggested by the BEs and using a splint to hold the switch in place was considered by the OTs.

Extract: "thinking of something simple which he can achieve with". 45, BE

In order to operate and select items on the communication aid or the EC device via switch access, **scanning** the contents using a row and column or linear pattern were mentioned by all professions (BE, *n*=11, 55%; OT, *n*=5, 25%; SLT, *n*=8, 40%). The BEs and SLTs considered it in similar detail which was greater than the OTs (BE, s=22; OT, s=8; SLT, s=16). The efficiency of the scanning system and the possible need for auditory scan was raised by all professions. Issues surrounding the use of auditory scan were mentioned by all professions.

Extract: *"that's potentially more frustrating or confusing for him and his communication partner."* 22, SLT

The **speed of switch access** was identified as a potential issue by up to 45% of participants from all professions (BE, *n*=7, 35%; OT, *n*=6, 30%; SLT, *n*=9, 45%). Although it was raised by more SLTs than OTs, the OTs talked about it in greater detail (BE, s=12; OT, s=16; SLT, s=11). All professions considered methods to increase the speed of access which included the use of word prediction and the reconstruction of words and sentences using an abbreviation expansion system. A two switch system was also suggested which could be used in a scanning pattern with one switch used for scanning and the second for selection. The SLTs also discussed the need to ensure that the user was aware of the slowed access.

Extract: *"realistic expectations of what the technology could do and that [it] wouldn't be as quick as speech"* 21, SLT

Topic 4: Technology Requirements

This code was defined as external factors which may have an impact on the functional use of the technology. Ninety-eight percent of participants (*n*=59, 100%; BE, *n*=20, 100%; OT, *n*=20, 100%; SLT, *n*=19, 95%) discussed this code. A similar amount of detail was provided by the BEs and OTs with the greatest provided by the SLTs (BE, s=184; OT, s=192; SLT, s=211).

The issue of recommending an **integrated or separate** communication aid, computer and environmental control system was considered by 90% and 85% of BEs and SLTs respectively and 65% of OTs (BE, *n*=18, 90%; OT, *n*=13, 65%; SLT, *n*=17, 85%). However, the OTs considered it in the greatest detail (BE, s=41; OT, s=52; SLT, s=41). The benefits of integration were perceived to be the same by all professions and these were primarily the reduction in hardware required to be wheelchair mounted; fewer switch access issues; an increase in portability and improved ergonomics. The SLTs suggested that dedicated communication aids were preferable because the battery life was perceived to be better than an integrated device.

The disadvantages of an integrated aid were raised primarily by the BEs. The OTs and SLTs spoke about the advantages of phasing the introduction of technology which would occur with separate systems whereas the introduction of a highly complex integrated system would be cognitively demanding and may not be as successful. The BEs detailed their concerns regarding the safety implications of using an integrated device. They advocated focusing on the safety-critical issues, security risks and the reliability of the system.

> **Extract:** *"to consider the aesthetics and how disabling something can look even if it's enabling*." 32, SLT

Between 60-70% of participants from each profession considered the implications of **prior technology use** and it was considered in the greatest detail by the SLTs (BE, *n*=12, 60%, s=39; OT, *n*=13, 65%, s=33; SLT, *n*=14, 70%,s=65). All professions assumed that a teenager would be familiar with technology and continued based on this assumption. The OTs stated that progress was likely to be faster with prior knowledge. All professions also enquired regarding prior exposure to and use of communication aids or computers. The SLTs considered the users' knowledge, likes and dislikes from prior experience in detail.

The **portability** and transportability of the device was discussed by over 50% of participants in all professions in similar detail (BE, *n*=10, 50%, s=27; OT, *n*=11, 55%, s=26; SLT, *n*=13, 65%,s=25). Having the ability to use the device within different settings was a key factor for all professions. In addition, the BEs focused upon the technical aspects of the device such as the battery life whereas the OTs considered the user's visual abilities in relation to the smaller screen. The SLTs were interested in how portability could enhance social communication.

> **Extract:** *"Portability, without compromising function; it's going to be a balance of that"* 36, BE

Funding of the communication aid and access method was raised as an issue by all professions and considered in greatest detail by the OTs (BE, *n*=9, 45%, s=17; OT, *n*=11, 55%, s=27; SLT, *n*=11, 55%, s=22). Each profession talked about the need to potentially modify their optimal prescription dependent upon what funding was available, particularly in relation to recommending eye gaze.

Ensuring a **child-friendly solution** was mentioned by 40% of SLTs and 55% of BEs and SLTs with the SLTs speaking about it in the greatest detail (BE, *n*=11, 55%, s=14; OT, *n*=11, 55%, s=18; SLT, *n*=8, 40%, s=20). All professions considered the configuration of the communication aid, taking into account the children's age-specific vocabulary requirements, the need for "quick-fire" responses and the desire to offer maternal guidance and wisdom. All recognised that communication with other parents was also likely to be required. The need for independent access to the TV, DVD and computer games was also raised in order to provide social interaction opportunities which were not reliant on speech. The BEs were also aware of potential trip hazards and the need for the device to be technically robust. The SLTs were concerned about the slow speed of access and the physical barrier created by the device between the user and the listener.

Extract: *"it can sort of limit her interactions with her kids if they're wanting to jump up on her knee."* 42, SLT

Between 40-50% of participants per profession were keen to ensure that the **user's priorities** were taken into consideration with the BEs providing the greatest detail (BE, *n*=8, 40%, s=24; OT, *n*=9, 45%, s=22; SLT, *n*=10, 50%, s=20). All professions suggested that communication was likely to be the main priority and they were committed to creating a solution around the user's priorities. The BEs talked about introducing technology which would motivate and the SLTs suggested that the appearance was likely to be important to a teenager.

Extract: *"anything that important, hopefully we'd be able to agree".* 44, OT

The availability of **internet access** was raised by more SLTs than BEs and OTs although the BEs discussed it in the greatest detail (BE, *n*=5, 25%, s=15; OT, *n*=4, 20%, s=10; SLT, *n*=7, 35%, s=14) All professions considered it in relation to social networking. The BEs considered the motivational aspects of using the internet such as web browsing, online gaming and using Skype. They also suggested that email would be preferable than using the phone to make calls. The OTs were interested in online shopping in order to increase independence.

Extract: *"reduce his isolation or increase his participation"* 32, SLT

The essential need for **maintenance and technical support** of the equipment was reported by 30% of BEs and 10% of the OTs and SLTs (BE, *n*=6, 30%, s=7; OT, *n*=2, 10%, s=4; SLT, *n*=2, 10%, s=4). The importance of maintaining the equipment was considered as important as provision. The OTs suggested that they would avoid prescription of eye gaze due to the maintenance and support required.

Extract: *"with such equipment… assessment and provision is one big part of it. Making sure that it continues is another big part...the backup, the service and maintenance is very, very important".*

Topic 5: Computer Specification

This code was defined as external factors which may have an impact on the functional use of the technology. Forty percent (*n*=33) of participants (BE, *n*=12, 60%; OT, *n*=9, 45%; SLT, *n*=12, 60%) discussed this code with the same number of BEs and SLTs and the least OTs. The OTs provided the least detail and SLTs the most with over twice the number of statements (BE, s=32; OT, s=18; SLT, s=45).

Computer access was considered by 40-50% of participants per profession with the SLTs discussing it in the greatest detail (BE, *n*=9, 45%, s=19; OT, *n*=9, 45%, s=10; SLT, *n*=8, 40%, s=24). All professions suggested that the same access method should be used for computer as for the communication aid and EC device. The layout of the screen and accessible software was raised by all professions.

The **identification of computer needs** was undertaken by 25% to 50% of participants per profession with the greatest number of SLTs raising it and discussing it in detail (BE, *n*=9, 45%, s=13; OT, *n*=5, 25%, s=8; SLT, *n*=10, 50%, s=21). All participants spoke about using online communication, social networking and using it for education in the future. It was proposed that a desktop computer would be better than a laptop in order to accommodate visual and physical needs.

7.2.4.2 **Concept 5: Equipment Solutions**

This concept is comprised of seven topics and eleven categories. The concept Equipment Solutions was defined as the selection, set-up and practical usage of the prescribed device.

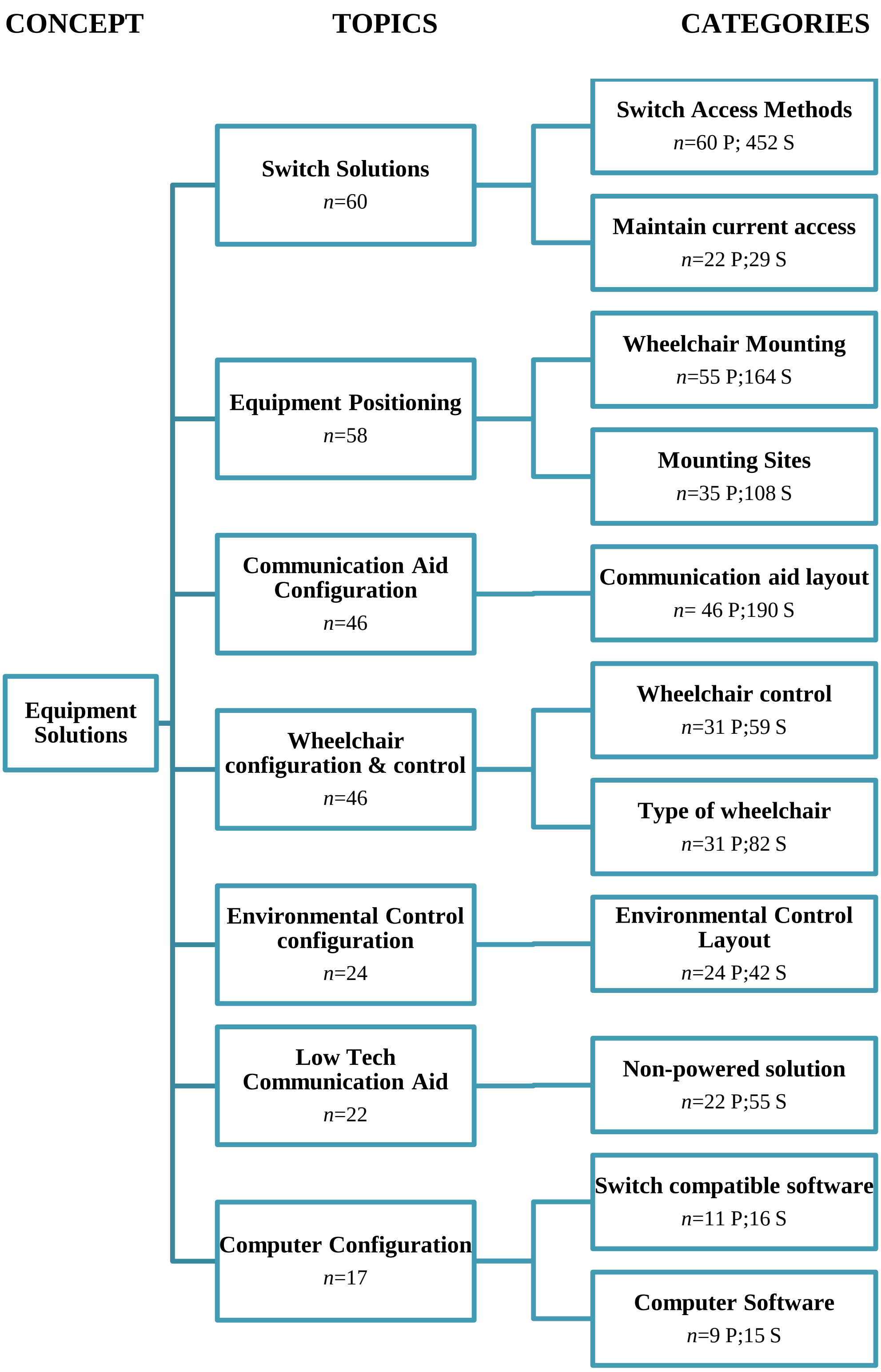


Figure 7.7: Concept 5: Equipment Solutions

Thematic content analysis of responses illustrating the concept, topics and categories derived from the data.

Topic 1: Switch Solutions

This code was defined as external factors which may have an impact on the functional use of the technology. One hundred percent (*n*=60) of participants (BE, *n*=20, 100%; OT, *n*=20, 100%; SLT, *n*=20, 100%) talked about this and the greatest detail provided by the OTs and the least by the BEs (BE, s=146; OT, s=173; SLT, s=162).

All participants recommended at least one **switch access methods** solution and the OTs discussed it in the greatest detail (BE, *n*=20, 100%, s=135; OT, *n*=20, 100%, s=167; SLT, *n*=20, 100%, s=150). All professions spoke about the need to identify a movement that was repeatable and the most frequently recommended solution by all professions for case A was use of lateral elbow movement to activate a switch positioned on the wheelchair (BE, *n*=11, 55%; OT, *n*=11, 55%; SLT, *n*=10, 50%).

Maintaining current switch access method for case B was recommended by less than 50% of all participants (BE, *n*=9, 45%; OT, *n*=5, 25%; SLT, *n*=8, 40%). Alternative recommendations differed between the professions and included the use of a shoulder switch (BE, *n*=4; OT, *n*=2; SLT, *n*=1); a highly sensitive EMG switch to pick up intentional flickering movement in the fingers (BE, *n*=5; OT, *n*=2; SLT, *n*=0) and eye gaze (BE, *n*=0; OT, *n*=1; SLT, *n*=7). The BEs raised concerns regarding the physical safety of the switch if placed on the outside of the chair and talked about ways of ensuring that it was best protected. The OTs were concerned about the aesthetics of adding a switch to the wheelchair and how it would be perceived by the user. They and the SLTs also considered the impact of repetitive movements upon muscle tone.

Extract: *"computer access and communication both require lots and lots and lots of repeats of switch access movements. Much more than you'd ever require for an environment control"* 50, SLT

Topic 2: Equipment Positioning

This code was defined as the physical placement of the devices to ensure optimal function. Ninety-seven percent (*n*=58) of participants (BE, *n*=20, 100%; OT, *n*=18, 90%; SLT, *n*=20, 100%) discussed equipment positioning and the greatest detail was provided by the BEs and the least by the SLTs (BE, s=116; OT, s=84; SLT, s=72).

Wheelchair mounting of the equipment, whether an integrated aid or separate devices and the switch access method was considered by over 90% of the participants and in the greatest detail by the BEs (BE, *n*=19, 95%, s=66; OT, *n*=18, 90%, s=50; SLT, *n*=18, 90%, s=48). Ensuring that the mounting was safe was the primary concern of all professions.

The BEs focused on the technical aspect of mounting the device to the wheelchair and spoke about overall safety of mounting the system. They were also aware of the need to eliminate accidental access. The OTs and SLTs stated that they would liaise with the BE regarding technical safety. The OTs were concerned that safety may be compromised when driving a powered wheelchair due to loss of the line of sight. Solutions that enable the mounting to swing away from the individual to allow personal care or in the event of an epileptic seizure were also raised by all professions.

> **Extract:** *"I don't think mounting should be an issue, because if she's got a power chair, stability should be okay, because she will have battery and motors and so on"* 54, BE.

Possible **mounting sites** were discussed by 55-60% of the participants with the BEs providing the greatest detail (BE, *n*=12, 60%, s=50; OT, *n*=11, 55%, s=34; SLT, *n*=12, 60%, s=24). The BEs and OTs considered the need for mounting sites near the bed, in an armchair and the wheelchair. The user's needs throughout the day were discussed which generated suggestions regarding additional sites. The BEs also considered the damage implications for situating the switch in relation to the width of internal doors and types of moveable mounts. The OTs and SLTs mentioned the importance of ensuring that the equipment did not impact the user's line of vision or their ability to make eye contact.

Topic 3: Communication Aid Configuration

This code was defined as the arrangement of the symbols, words and pictures on the device in order to enable optimal function. It was discussed by 77% (*n*=46) (BE, *n*=14, 70%; OT, *n*=13, 65%; SLT, *n*=19, 95%) of the participants and the SLTs spoke about it in the greatest detail and made twice as many statements as the BEs and OTs (BE, s=50; OT, s=40; SLT, s=100).

All professions addressed the configuration and **layout of the communication aid** with the SLTs providing the greatest detail (BE, *n*=14, 70%, s=50; OT, *n*=13, 65%, s=40; SLT, *n*=19, 95%, s=100). Although the same issues were raised by all professions differences were apparent in the rationale for their recommendations. The BEs were interested in fast access to communication whereas the OTs and SLTs were focused on enabling functional use and assisting social engagement. All professions recommended a dynamic screen with a frequency layout whereby it was suggested that the layout should initially be straightforward and simple and become more complex over time and expandable for future needs. The content of the main menu and sub-menus should be based upon the user's priorities and all professions recommended the use of phrases and potentially with accompanying icons. The SLTs spoke in detail regarding the vocabulary required and suggested topics that should take priority such as interaction with the children and personal needs. All professions also recommended that word and phrase prediction should be a key feature in addition to expansion into other languages.

Extract: "y*ou could kind of take screen shots as pictures and put them in as words..[and] choose someone to be her voice".* 29, OT

This code was defined as the technical set-up of the wheelchair and method of operation. It was discussed by 77% (*n*=46) of participants (BE, n=14, 70%; OT, n=18, 90%; SLT, n=14, 70%) and the BEs provided the greatest detail with almost three times the number of statements than SLTs (BE, s=66; OT, s=49; SLT, s=26).

Between 45 and 55% of participants discussed the users' **wheelchair control** and the BEs spoke in the greatest detail (BE, *n*=11, 55%, s=27; OT, *n*=11, 55%, s=17; SLT, *n*=9, 45%, s=15). All professions discussed the competency, reliability and effectiveness of control in relation to vision, physical capability and use of the joystick.

The **type of wheelchair** was raised by 30-75% of the participants with the greatest number of OTs and discussed in the greatest detail by the BEs (BE, *n*=9, 45%, s=39; OT, *n*=15, 75%, s=32; SLT, *n*=7, 30%, s=11). All professions discussed the use of and ability to use a powered chair and the SLTs recommended liaison with a specialist wheelchair service.

The BEs and OTs considered the users' physical abilities, the criteria for and the practicalities of assessing for and using a wheelchair outdoors. They also raised the need to ensure a regular wheelchair review.

Extract: *"I will have to see the wheelchair is sorted adequately."* OT, 60

Topic 5: Environmental Control Configuration

This code was defined as the technical set-up of the ECS. The **environmental control layout** was raised by 25-55% of all professions, and primarily by the BEs who also provided the greatest detail (BE, *n*=11, 55%, s=23; OT, *n*=8, 40%, s=14; SLT, *n*=5, 25%, s=5). The BEs recommended that the device should be simple to use and become more complex over time, programmed in order to fulfil everyday and leisure needs and should incorporate an emergency call system. They suggested that it should be portable and be able to operate from the bedside. The OTs recommended that it should contain a full range of EC functions from the outset; have bespoke phrases and comments and should be able to function throughout the entire house using either infrared or radio technology. The SLTs recommended that it should be a separate system, apart from the communication aid.

Extract: *"door opening, curtains, light switch, TV, radio*", 37, OT

Topic 6: Low-tech communication aid

This code was defined as an augmentative or alternative means of communication which does not required power and may include drawings, pictures and eye gaze. It was raised by 37% of participants and predominately by the SLTs (BE, *n*=1, 5%; OT, *n*=6, 30%; SLT, *n*=15, 75%).

In relation to a communication aid, a **low-tech solution** was recommended by 75% of the SLTs in contrast to 5% of BEs and 30% of OTs (BE, *n*=1, 5%; OT, *n*=6, 30%; SLT, *n*=15, 75%). It was discussed in the greatest detail by the SLTs (BE, s=1; OT, s=9; SLT, s=45).

The SLTs and OTs discussed the use of a low-tech communication aid as an alternative solution when a high-tech was not appropriate. It was also suggested as a backup solution or as an introduction to using augmentative communication. The SLTs also reflected on the difficulties with the acceptance of using a low- tech solution suggesting that it may be perceived as simplistic.

Extract: "*she may need to communicate with the carers, such as in the bathroom and in the shower."* 50, SLT

Topic 7: Computer Configuration

This code was defined as the technical set-up of the computer and method of operation. It was discussed by 28% (*n*=17) of participants with similar numbers per profession (BE, *n*=6, 30%; OT, *n*=5, 25%; SLT, *n*=6, 30%). A similar number of statements were generated by the BEs and SLTs with the OTs providing the least detail (BE, s=12; OT, s=8; SLT, s=11).

The need for **switch compatible software** was considered by 10-25% of the participants and in similar level of detail by the BEs and SLTs (BE, *n*=5, 25%, s=8; OT, *n*=2, 10%, s=2; SLT, *n*=4, 20%, s=6). All professions detailed the need for programmes to be accessible via switch access in addition to being compatible.

> **Extract:** "*the types of software he'd be using at college and whether or not that software was compatible, because sometimes there are issues of compatibility with the single switch software .. particularly if they have a lot of high graphics content."* 11, OT

The **computer setup** was considered by 10-20% of participants and in similar level of detail by all professions (BE, *n*=2, 10%, s=4; OT, *n*=4, 20%, s=6; SLT, *n*=3, 15%, s=5). All professions recommended modification of the visual display settings; discussed the need to access the internet from within the communication software and for the computer to synchronise settings and programmes with a communication aid to ensure seamless usage.

> **Extract:** "*consistent user interface, using the [communication software] both on the computer at home and on the communication aid."* 14, OT

7.2.4.3 **Concept 6: Implementation of technology**

This concept was defined as the process of putting into place the prescribed technological solution.

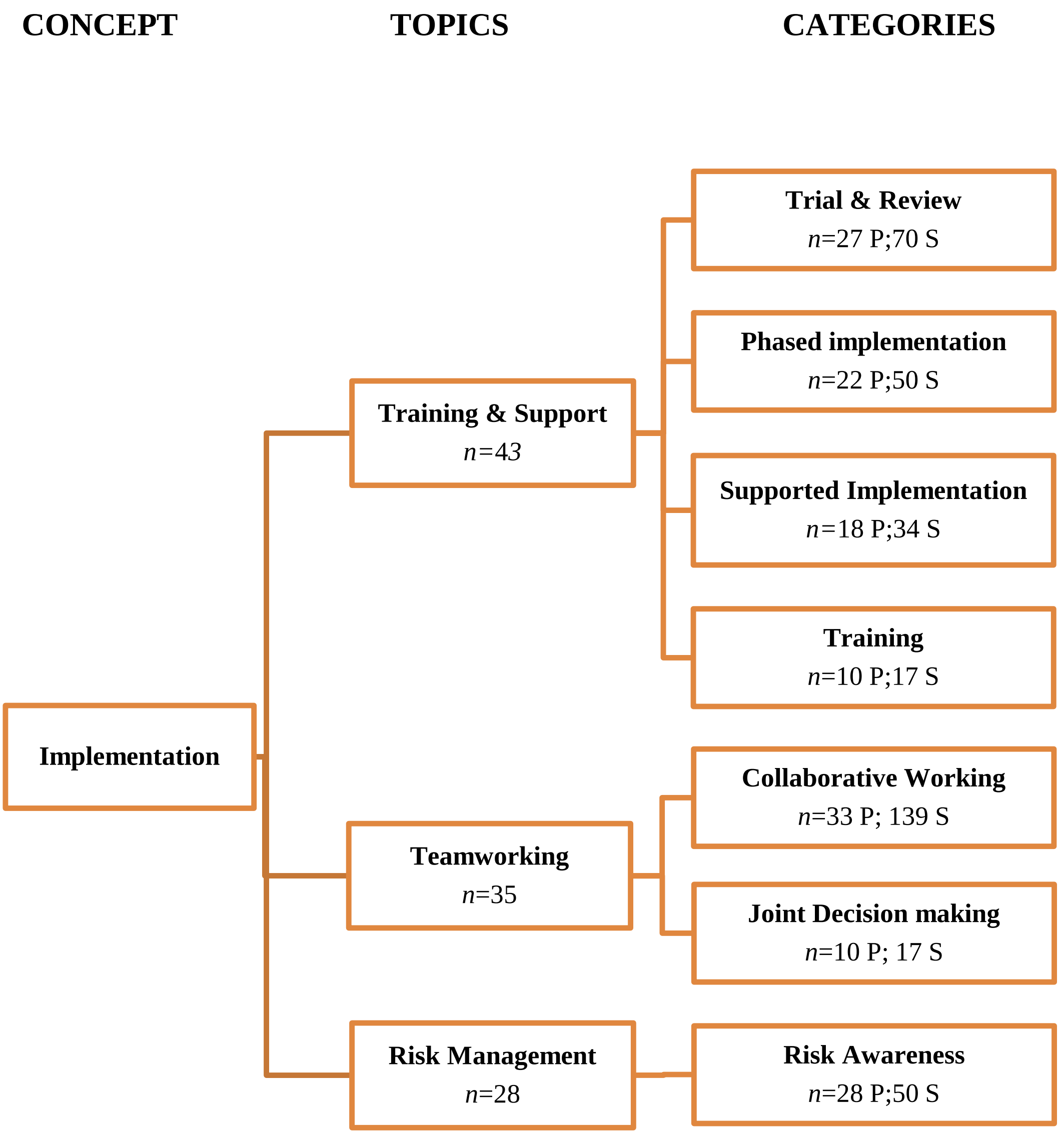


Figure 7.8: Concept 6: Implementation of Technology

Thematic content analysis of responses illustrating the concept, topics and categories derived from the data.

Topic 1: Training & Support

This code was defined as the process of educating and supporting the user and their social circle on how to use the prescribed EAT. It was raised by 72% of participants with the same number of OTs and SLTs and the least BEs (BE, *n*=13, 65%; OT, *n*=15, 75%; SLT, *n*=15, 75%). There was little difference in the level of detail provided by the OTs and SLTs with the least detail provided by the BEs (BE, s=47; OT, s=61; SLT, s=63).

Forty percent of BEs and SLTs and 55% of OTs spoke about the need to **trial and review** the equipment prior to final prescription and the SLTs discussed it in the greatest detail (BE, *n*=8, 40%, s=22; OT, *n*=11, 55%, s=20; SLT, *n*=8, 40%, s=28). All professions recommended that practice in the home setting for at least six weeks was necessary in order to assist with functional use. The OTs suggested that a review would enable the prescription to be amended if the user had got potential to change. The SLTs advocated a review as the equipment was very expensive and they were concerned that it may not be used and wanted to get feedback from the family.

Extract: *"establish and achieve a result in terms of what this client is able to do"* 35, BE

Between 30 and 45% of participants recommended **phased implementation** of the equipment and the OTs discussed it in the greatest detail (BE, *n*=9, 45%, s=19; OT, *n*=6, 30%, s=19; SLT, *n*=7, 35%, s=12). The BEs described implementation as a staged process and the SLTs commented upon the delay inherent in sourcing funding. All professions recommended that the device(s) should be introduced over time once the user was in their home environment in order to allow them time to ascertain their needs and preferences in relation to communication and EC. This period also enabled skills to be learnt and be embedded slowly and thoroughly.

Extract: *"put [communication software] on his home computer that he can practice with to develop skills… then expand to communicate whilst he's out and about and also when he does go back to college"* 22, SLT

The need for **supported implementation** of the equipment was raised the most by SLTs and spoken about in greatest detail by the OTs (BE, *n*=4, 20%, s=4; OT, *n*=6, 30%, s=17; SLT, *n*=8, 40%, s=13). All professions suggested that support was necessary to ensure optimal use. The SLTs mentioned the need to build-up the families' confidence in addition to the user in learning how to use the device by implementing a structured programme. It was anticipated that such support would be provided by the OTs and SLTs.

Extract: "*How she wants to use technology is pretty complex and it's going to need quite a lot of support."* 34, SLT

The need for **training** was raised primarily by the SLTs who also spoke about it in the greatest detail (BE, *n*=2, 10%, s=2; OT, *n*=1, 5%, s=5; SLT, *n*=7, 35%, s=10). Provision of training for the family and carers was mentioned by all professions. The OTs also considered the need for the SLT to teach family and friends' communication interaction strategies. The SLTs discussed provision of intensive training in order to develop skilled and efficient use of the device. They also recommended training for using low-tech aids.

Topic 2: Team-working

This code was defined as working in collaboration with other EAT professionals from different disciples during assessment for EAT. Team-working was raised by 58% (*n*=35) of participants and the same number of OTs and SLTs and the least by BEs. The SLTs provided the greatest detail with three times as many statements as the BEs (BE, s=26; OT, s=44; SLT, s=86).

The need for **collaborative working** was raised by 70% of SLTs, 60% of OTs and 35% of BEs with the SLTs discussing it in the greatest detail (BE, *n*=7, 35%, s=25; OT, *n*=12, 60%, s=39; SLT, *n*=14, 70%, s=75). All professions spoke about the need to collaborate with BEs, OTs, SLTs and, to a lesser extent, Physiotherapists. BEs were consulted for advice on EC systems by the OTs and mounting and switch positioning by the SLTs. OTs were consulted for advice on fatigue, head control, home adaptations and motivation by the BEs, for the built environment, physical access and positioning by OTs (where necessary) and for physical functioning and wheelchair adaptions by the SLTs. SLTs were consulted for advice on communication environments and appropriate software by the BEs and assistance with the user's communication abilities, communication aid and software by the OTs. Physiotherapists were consulted with regard to positioning and the potential for physical improvement by all professions. The SLTs were keen to liaise with their counterparts in the rehabilitation units and community teams to secure further clinical information in relation to former goals and achievements.

Extract: *"I'd want to be liaising with physio about positioning of a communication aid and how to work with them rather than against them in terms of putting the aid in a position that works to both of our advantage."* 7, SLT

Joint decision making was considered primarily by the OTs and SLTs with the SLTs providing the greatest detail (BE, *n*=1, 5%, s=1; OT, *n*=4, 20%, s=5; SLT, *n*=5, 25%, s=11). All professions discussed undertaking joint assessments and ensuring that members of the team did not work in isolation.

Topic 3: Risk Management

This topic was defined as the identification and management of potential risks when implementing EAT.

Risk awareness was raised by all professions but predominately by the BEs who also discussed it in the greatest detail (BE, *n*=13, 65%, s=26; OT, *n*=7, 35%, s=12; SLT, *n*=8, 40%, s=12). The BEs talked about the risks of integrating the EC and communication aid systems in relation to safety critical issues. They considered the users to be vulnerable adults and outlined the risks involved in enabling door entry on the EC system. The battery life, robustness and technical reliability of the device and mounting risks were also considered by the BEs. The BEs and the OTs considered the risk of loose wires and other trip hazards. The SLTs primarily considered risk in relation to the mounting of the device on the wheelchair and placing the user at risk of having the device stolen.

Extract: *"something separate as a failsafe for raising the alarm. Something safety critical like that, we always—we wouldn't rely on a PC for it".* 56, BE

7.3 THE PROCESS OF CLINICAL DECISION MAKING

7.3.1 Introduction

Thus far, results have been presented which detail the content of the decision making undertaken by the participants as they assessed and prescribed EAT. This section reports on the cognitive processes involved during this task. All verbal protocols were analysed to investigate the use of the two models of decision making from which the dual-process model is composed. (The justification and methodology can be found in Chapter 2, Section 2.3.2.4 and Chapter 6, Section 6.5.6.2 respectively. Examples of verbatim statements from the data are presented in boxes with the participant number and profession.

7.3.2 Chapter Layout

This chapter presents the process results in the following order:

1. Identification of similarities and differences between the professions, work settings, experience and self-rated expertise based upon the:
    a. hypothetico-deductive model;
    b. heuristics model;
    c. decision making process codes.
2. Patterns in the use of decision making processes.

7.3.3 Hypothetico-Deductive Approaches To Decision making

Each protocol was analysed according to the four stages identified by Elstein (1978) as outlined in the methodology and applied during the pilot study. However, the participants were utilising additional processes in their decision making and two extra stages, **cue implication** and **hypothesis implementation** were derived from the data.

Although the Elstein (1978) model is not intended to be a linear model, the order of the codes presented in his research represented the typical order of use and this order has been preserved and the additional stages are included based upon their typical stage of occurrence within the current data. **Cue implication** was an intermediate step between cue acquisition and hypothesis generation where the participants utilised the clinical information to consider how it may affect the introduction of assistive technology but were not at the stage of generating a solution, which is the hypothesis generation stage. **Hypothesis implementation** occurred after hypothesis evaluation, during which participants considered issues which may impact upon the implementation of their recommended solution. The enhanced stages of the hypothetico-deductive model are reported later in the chapter and an example statement is included.

7.3.3.1 Descriptive Analysis of the Enhanced Hypothetico-Deductive Model Coding

An analysis of each code follows Table 7.1 which shows a descriptive analysis of the frequency of occurrence for each code in addition to the total number of participants generating each code and the total statements per code.

Table 7.1: Frequency of Occurrence for Enhanced Hypothetico-Deductive Model Codes

Enhanced Hypothetico-Deductive Model Codes	Statements Coded	Total Occurrence of Code	Total Participants Generating Code by Profession			Total Statements Coded by Profession		
			BE	OT	SLT	BE	OT	SLT
Cue Acquisition	2,300	59.43%	*n*=20, 100%	*n*=20, 100%	*n*=20, 100%	670	706	924
Cue Implication	476	12.29%	*n*=18, 90%	*n*=20, 100%	*n*=20, 100%	156	134	186
Hypothesis Generation	890	22.99%	*n*=20, 100%	*n*=20, 100%	*n*=20, 100%	286	287	317
Cue Interpretation	96	2.48%	*n*=10, 50%	*n*=10, 50%	*n*=17, 85%	29	28	39
Hypothesis Evaluation	90	2.32%	*n*=8, 40%	*n*=13, 65%	*n*=17, 85%	17	35	38
Hypothesis Implementation	18	0.46%	*n*=4, 20%	*n*=6, 30%	*n*=5, 25%	5	5	8

7.3.3.2 Configuration of Decision Making Stages

Analysis of the data shows that 53% (n=32) of the participants utilised the four stages of Elstein's (1978) hypothetico-deductive model, 31 (52%) of whom used it in combination with cue implication and hypothesis implementation. Figures 7.9 to 7.17 below illustrate the combination of the stages used by all participants. They are presented in descending order commencing with the combination used by the greatest number of participants. Each diagram presents a multidirectional cycle in order to represent a continuing sequence of stages that can occur in any direction. The six stages are included in all diagrams and those that were not utilised are greyed out. The names of the stages have been abbreviated to enable easier viewing and comparison.

a) Cue Acquisition

This code was the most frequently employed code (59.43%) and was utilised by all participants (*n*=60, 100%). It was applied most frequently by the SLTs (s=924) and least by the BEs (s=670). Figures 7.9 to 7.17 illustrate the use of this stage in relation to the other stages also undertaken.

> **Extract:** *"Do her parents, do they have good English or are they predominantly Urdu speakers?"* 33, OT

b) Cue Implication

Within this study, cue implication was defined as the process of utilising the clinical information to consider how it may affect the introduction of AT but not yet developing a hypothesis (solution).

This code was employed by 97% (*n*=58) of participants with a similar pattern and like cue acquisition was applied most frequently by the SLTs (s=186) and least by the BEs (s=156). It accounted for 12.29% of the coding and the protocols of the two BEs who did not employ this code show a rapid process of decision making and prescription. Figures 7.9 to 7.15 illustrate the use of this stage in relation to the other stages also undertaken.

Extract: *"His epilepsy is likely to make him ineligible for power mobility, because you could never be sure he wouldn't have one while driving somewhere…. dangerous. His mood swings might be a problem, because he might only use it as a weapon. That would worry me a bit.*" 58, BE

c) Hypothesis Generation

This code was the second most commonly used code (22.99%) by all participants (*n*=60). It was applied most frequently by the SLTs (s=317) and to a similar extent by the BEs (s=286) and OTs (s=287). All participants generated multiple partial or complete solutions. Due to the nature of the task it was appropriate to code partial solutions as they were elements of the solution, such as a method of physical access and a type of environmental control system which were components of the total solution. Figures 7.9 to 7.17 illustrate the use of this stage in relation to the other stages also undertaken.

Extract: *"The fact that he wants to use computers as well as communicate and the fact that he's going back [to] college, I would definitely be thinking about something that does all of those things for him. Some high tech tablet based sort of device. Not necessarily a dynamic.... I think I would use a dynamic communication system, but I would probably be much more focused on the text side of things. I would be thinking about using a device that wasn't just a dedicated communication device that also had the PC facility to use Word and various other bits of software."* 11, OT

d) Cue Interpretation

This code was employed by 62% (*n*=37) of participants and was not frequently utilised and it accounted for 2.48% of the coding. It was applied most frequently by the SLTs (s=39) and to a similar extent by the BEs (s=28) and OTs (s=29). It did not always co-exist with the use of hypothesis evaluation as suggested by Elstein (1978) although it did for 53% (*n*=32) of participants. Figures 7.9, 7.11, 7.14, 7.15 and 7.16 illustrate the use of this stage in relation to the other stages also undertaken.

Extract: *"There is a lot of elbow movement and I couldn't see any shoulder movement. You could have the switch on the outside... although if you put the switch on the outside of the chair, it's going to get smashed up on the first door post."* 23, BE

e) Hypothesis Evaluation

Sixty-three percent (*n*=38) of participants utilised this code with the SLTs and OTs generating the code with a similar level of frequency (OT, s=35; SLT, s=38) and the BEs the least (s=17). Elstein et al (1978) proposed that within diagnostic decision making the hypotheses generated are explicitly evaluated 10and an evaluation can be made regarding the best fit for the presenting symptoms. Within this study, such explicit evaluation was undertaken by 63% (*n*=38) participants, 53% (*n*=32) of whom had also used cue interpretation. Figures 1,3,4 and 9 illustrate the use of this stage in relation to the other stages also undertaken.

Extract: *"Final recommendation would be a portable switch access the switch access being eye-pointing or head, lateral head-turning to operate perhaps The Grid on it, on a computer like Tobii or computer system that also had environmental controls and mobile phone functions, you know involved, well integrated in it as well"* 12, SLT

f) Hypothesis Implementation

Within this study, Hypothesis Implementation was defined as the impact of the proposed solution or solutions upon the real setting of the user. Twenty-five percent (*n*=15) of participants employed this code with little difference between the professions (BE, s=5; OT, s=5; SLT, s=8). A total of 18 statements were coded as Hypothesis Implementation corresponding to 0.46% frequency of occurrence. Almost half of these participants, 46% (n=6) used hypothesis implementation in addition to the five preceding codes. Figures 7.11, 7.13 and 7.15 illustrate use of this stage in relation to the other stages also undertaken.

Extract: *"And then, once he's home, review his need for environmental controls and also to keep an on-going assessment to see if he does, his hand function improves at all, to review the switching and allow him to have the equipment for assessment with his family and with friends."* 6, OT

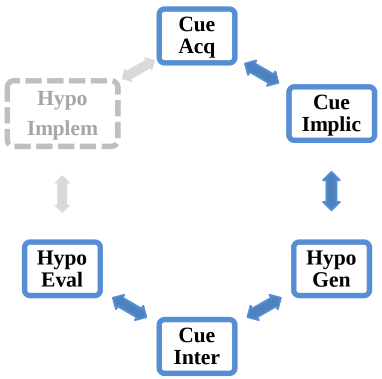


Figure 7.9

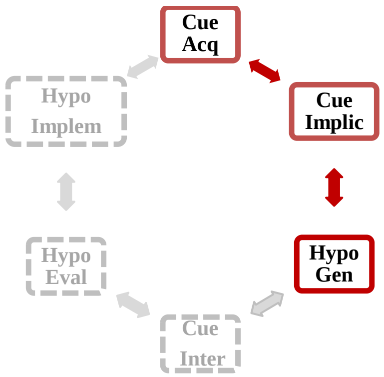


Figure 7.10

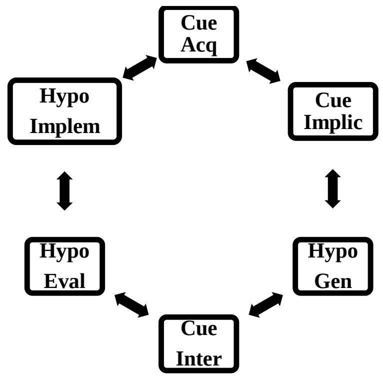


Figure 7.11

Stages used by 42% (n=25) participants
(BE, *n*=5, 25%; OT, *n*=9, 45%; SLT, *n*=11, 55%)

Stages used by 16% (n=10) participants
(BE, *n*=6, 30%; OT, *n*=2, 10%; SLT, *n*=2, 10%)

Stages used by 10% (n=6) participants
(BE, *n*=1, 5%; OT, *n*=1, 5%; SLT, *n*=4, 20%)

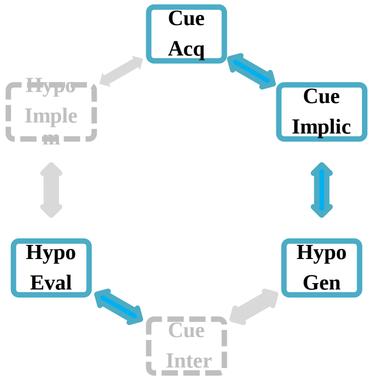


Figure 7.12

Stages used by 10% (n=6) participants

(BE, *n*=1, 5%; OT, *n*=4, 20%; SLT, *n*=1, 5%)

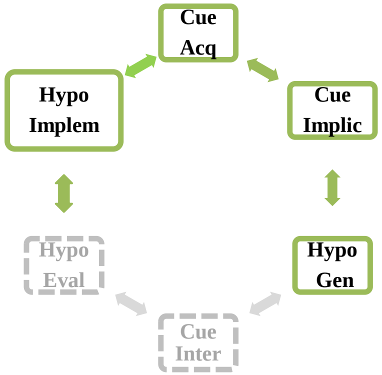


Figure 7.13

Stages used by 8% (n=5) participants

(BE, *n*=2, 10%; OT, *n*=2, 10%; SLT, *n*=1, 5%)

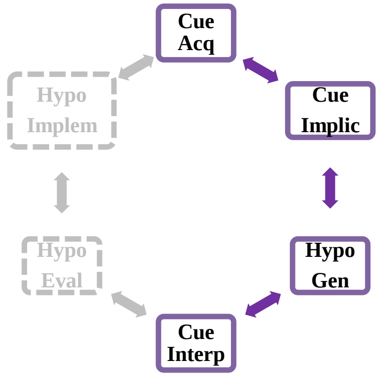


Figure 7.14

Stages used by 7% (n=4) participants

(BE, *n*=2, 10%; OT, *n*=1, 5%; SLT, *n*=1, 5%)

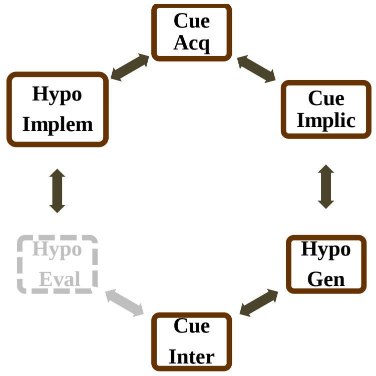


Figure 7.15

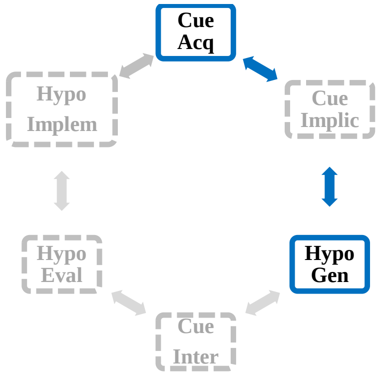


Figure 7.16

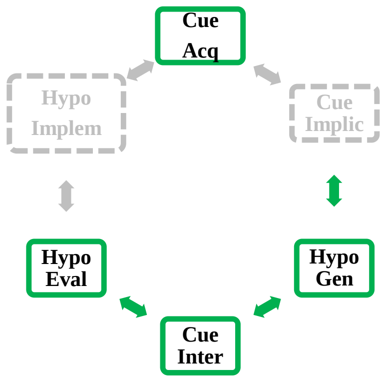


Figure 7.17

Stages used by 3% (n=2) participants

(BE, *n*=1, 5%; OT, *n*=1, 5%; SLT, *n*=0)

Stages used by 2% (n=1) participant

(BE, *n*=1, 5%; OT, *n*=0; SLT, *n*=0)

Stages used by 2% (n=1) participant

(BE, *n*=1, 5%; OT, *n*=0; SLT, *n*=0)

7.3.3.3 Identification of Similarities and Differences between the Professions, Work Settings, Experience and Self-Rated Expertise

In order to investigate the similarities and differences between the professions, work settings, experience and self-rated expertise, a chi-square test was performed to determine if there were statistically significant differences between the use of the hypothetico-deductive stages across a range of categorical variables. Because the sample size was relatively small for some statistical examinations, the data of the five levels of expertise were condensed into two levels which were named Capable and Accomplished. The new levels were generated by grouping together closely related stages of expertise on the Dreyfus and Dreyfus (1986) continuum. The Capable category included the Beginner, Advanced Beginner and Competent categories and Accomplished included the Proficient and Expert categories. Similarly the experience in EAT and ABI was grouped into two categories, above and below the group median. The level of significance for all tests was p=0.05.

1. **Difference between professions**: The test failed to indicate a significant difference between the three professions regarding their frequencies of stage use, with values ranging between p=0.17 to p=0.62.

2. **Difference between work settings**: The test failed to indicate a significant difference between those participants who worked in an assistive technology centre or a brain injury unit regarding their frequencies of code use, with values ranging between p=0.21 to p=0.63.

3. **Difference between experience in electronic assistive technology**: The experience data were divided into two groups according to whether the participants had less than 10 years of experience or equal and more than 10 years of experience. The test indicated a significant difference between experience in EAT regarding the frequency of the use of hypothesis generation with p=0.02. This indicated there was an increase

in the amount of hypothesis generation undertaken by those who had over 10 years EAT experience. The values ranged from *p*=0.12 to *p*=0.97 for the remaining codes.

4. **Difference between experience in acquired brain injury:** The experience data were divided into two groups according to whether the participants had less than 11 years of experience or equal and more than 11 years of experience. The test did not indicate a significant difference between experience in ABI regarding the frequencies of stage use, with values ranging between *p*=0.15 to *p*=0.56.

5. **Difference between self-rated level of expertise**: The test failed to indicate a significant difference between the Capable and Accomplished categories of self-rated expertise regarding the frequencies of stage use, with values ranging between *p*=0.11 to *p*=0.70.

Table 7.2 presents a summary of the Chi-Square tests results. Full results of the Chi-Square test are available in Appendix 10

Table 7.2: Results of the Chi-Square Test Investigating the Relationship between the Frequency of Occurrence for Stages of the Enhanced Hypothetico-Deductive Model and Profession and Participant Characteristics

Enhanced Hypothetico-Deductive Model	Profession	Setting	EAT Experience	ABI Experience	Self-rated Expertise
	Level of significance p = 0.05				
Cue Acquisition	0.35	0.22	0.52	0.52	0.13
Cue Implication	0.62	0.63	0.12	0.15	0.70
Hypothesis Generation	0.17	0.33	**0.02**	0.18	0.22
Cue Interpretation	0.55	0.21	0.51	0.36	0.23
Hypothesis Evaluation	0.22	0.25	0.56	0.56	0.57
Hypothesis Implementation	0.44	0.30	0.97	0.56	0.11

7.3.4 Descriptive Analysis of Heuristics Model Coding

Heuristics were employed throughout the verbal protocols less frequently than the hypothetico-deductive approach. They were used most frequently by SLTs and the least by OTs (BE, *n*=27, 45%; OT, *n* =21, 35%; SLT, *n* =35, 58%). Details for each heuristic are reported below in order of frequency of use. Table 7.3 shows the descriptive statistic results.

7.3.4.1 Descriptive Analysis of Heuristics Model of Decision Making Coding

An analysis of each code follows Table 7.3 which shows a descriptive analysis of the frequency of occurrence for each code in addition to the total number of participants generating each code and the total statements per code.

Table 7.3: Frequency of Occurrence for Heuristics Model of Decision Making Codes

Heuristic Model Codes	Statements Coded	Total Occurrence of Code	Total Participants Generating Code by Profession			Total Statements Coded by Profession		
			BE	OT	SLT	BE	OT	SLT
Representativeness	77	45.56%	*n*=12, 60%	*n*=8, 50%	*n*=13, 65%	31	20	26
Availability	64	37.86%	*n*=11, 55%	*n*=10, 10%	*n*=14 , 70%	19	18	27
Anchoring and Adjustment	28	16.56%	*n*=4, 20%	*n*=3, 15%	*n*=8, 40%	7	3	18

a) Representativeness

Representativeness was the heuristic most frequently employed by all professions (*n*=33, 55%; BE=12, 60%; OT=8, 50%; SLT=13, 65%) and it was employed in relation to the user's personal situation and equipment.

All professions used the representativeness heuristic within the personal context and usage primarily contributed towards how the participant viewed the user, their culture and their family situation. In relation to equipment it was used to consider the likelihood of equipment usage and technology familiarity.

Extract re: personal context: *"He .. the way he got his head injury, often, you know, head injury. Certain kind of person, maybe*." 41, SLT.

Extract re: cultural context: *"It is very difficult to use a communication aid, especially—it is hard for the Asian culture to accept people with disabilities, because usually they put them away or they put them in a corner and forget about them, especially with her being a woman as well. Those two things would be difficult. When you throw it all in the mix with the cultural background and the fact that the mother has got to look after the home, I would imagine the mother-in-law would have a lot to do with the upbringing of the children."* 49, BE

Extract re: equipment: *"Jordan is 18 and he's a young guy. Invariably, he probably knows Facebook and all the social networks on a computer, which means that he'll have to log in daily if he's an addict like these people are*." 18, OT.

b) Availability

This heuristic was used by the most participants (*n*=35, 58%; BE=11, 55%; OT=10, 50%; SLT=14, 70%) and it was employed in relation to the equipment solution. Solutions applied in previous cases were considered and on occasion utilised.

Extract: *"She's sounding very like a lady that we've seen who had very similar difficulties and very similar needs in terms of her bilingualism and that kind of thing. So that's great and kind of apply some of the problem solving that we did for her to this."* 35, OT

c) Anchoring and Adjustment

This heuristic was utilised by the fewest participants and was employed the least (*n*=15, 25%; BE=4, 20%; OT=3, 15%; SLT=8, 40%). It was primarily used in relation to the users' personal and equipment needs. Adjustment of the baseline comment, the anchor, did not always occur immediately, if at all and the resultant solutions were predicated upon the anchor assumption.

Extract: " *He lives in a high rise flat in the inner city area, which has given me some thoughts about what his family might have, in terms of what resources they have in terms of money and space and those kinds of things. But it might be a place on a really posh part, but I'm thinking possibly not."* 24, SLT

7.3.4.2 Identification of Similarities and Differences between the Professions, Work Settings, Experience and Self-Rated Expertise

In order to investigate the similarities and differences between the professions, work settings, experience and self-rated expertise, a chi-square test was performed to determine if there were statistically significant differences between the frequency in the use of heuristics across the following range of categorical variables. The same categories were used as with the hypothetico-decuctive model. The level of significance for all tests was $p=0.05$. There were no statistically significant differences between the variables.

1. **Difference between professions**: The test did not indicate a significant difference between the three professions regarding their frequencies of heuristic use, with values ranging between $p=0.26$ to $p=0.41$.

2. **Difference between work settings**: The test failed to indicate a significant difference between those participants who worked in an assistive technology centre or a brain injury unit regarding their frequencies of heuristic use, with values ranging between $p=0.51$ to $p=0.95$.

3. **Difference between experience in electronic assistive technology**: The test did not indicate a significant difference between those participants with shorter and longer experience in EAT regarding their frequencies of heuristic use, with values ranging from $p=0.22$ to $p=0.68$.

4. **Difference between experience in acquired brain injury:** The test failed to indicate a significant difference between shorter or longer

experience in ABI regarding the frequencies of heuristic use, with values ranging between p=0.20 to p=0.57.

5. **Difference between self-rated level of expertise**: The test failed to indicate a significant difference between the Capable and Accomplished self-rated levels of expertise regarding the frequencies of heuristic use, with values ranging between p=0.17 to p=0.80.

Table 7.4 presents a summary of the chi-square tests results. Full results of the chi-square test are available in Appendix 10.

Table 7.4: Results of the Chi-Square Tests Investigating the Relationship between the Frequency of Occurrence of Decision Making Heuristics and Profession and Participant Characteristics

Heuristic Model of Decision Making	**Profession**	**Self-rated Expertise**	**Work Setting**	**EAT Experience**	**ABI Experience**
	Level of significance p = 0.05				
Representativeness	0.41	0.17	0.51	0.65	0.20
Availability	0.26	0.80	0.89	0.68	0.57
Anchoring and Adjustment	0.38	0.62	0.95	0.22	0.55

7.3.5 Descriptive Analysis of the Decision Making Process Codes

Twelve codes, derived from the pilot study, were used to analyse the process of decision making undertaken by the participants when thinking aloud during the case scenario task. The code ‘Discard’ was applied to segmented data that were irrelevant, such as remarks which were empathetic, sympathetic or personal opinion or where an explanation was provided instead of thinking aloud and which did not contribute to the decision making process. The data segmented under this code will not, therefore, be reported in the following results. The data coded as Discard is available in Appendix 12. The frequency of occurrence, the total number of participants generating each code and the total statements per code are reported in Table 7.5 for all other 11 codes. Examples of verbatim statements of each code taken from the data are presented in Table 7.6, with the relevant participant number and profession.

Table 7.5: Frequency of Occurrence for Decision Making Process Codes

Decision Making Process Code	Statements Coded	Total Occurrence	Total Participants Generating Code by Profession			Total Statements Coded by Profession		
			BE	OT	SLT	BE	OT	SLT
Collect	4,077	26.98%	20, 100%	20, 100%	20, 100%	1,148	1,334	1,589
Formulate	3,432	22.7%	20, 100%	20, 100%	20, 100%	993	1,140	1,271
Deduce	1,557	10.3%	20, 100%	20, 100%	20, 100%	538	421	600
Reflect	1,444	9.55%	20, 100%	20, 100%	20, 100%	402	398	630
Reason	906	5.99%	20, 100%	20, 100%	20, 100%	285	288	324
Judging	802	5.3%	20, 100%	19, 95%	20, 100%	281	238	281
Interpret	777	5.14%	20, 100%	20, 100%	20, 100%	257	254	285
Prescribe	569	3.76%	20, 100%	20, 100%	19, 95%	212	185	173
Restate	560	3.7%	20, 100%	20, 100%	20, 100%	140	169	255
Predict	58	0.38%	13, 65%	7, 35%	11, 55%	28	10	16
Review	25	0.16%	3, 15%	2, 10%	4, 20%	9	8	8

Table 7.6: Example Statements of Each Code from the Verbal Protocols

Decision making process code	Example statement from verbal protocol
Collect	I want to know whether he has seizures and how often they occur and what the effects are of those seizures 7, SLT
Formulate	Difficult to have his head back tilted on gravity if his field of vision is up in the air. So that means we've got to put anything he's looking at up in the air, too. There is probably a tolerance of that 5, BE
Deduce	I certainly could pick up on her communication would improve through familiarity but in a very short, little bit of information that Razia presented for us I would have said she doesn't have any problem in getting her point across and making her needs known 35, BE
Reflect	One question being what the language at home, but I guess that's English as well. 4, BE
Reason	because without actually going back in time and with that second generation when they used to use a dictate word by word, 2 BE
Judging	I don't think that's very useful for me. 3, OT
Interpret	Okay, so it's a lowness of mood, it's not a violence or a no, 8, SLT
Prescribe	He'd actually got, he'd got enough flickers in both hands so, possibly for computer use he could have two switches if that speeded up the process. 10, OT
Restate	We've got somebody who is quite literate and wanting to study and wanting a computer., 11 OT
Predict	I still think he's going to get very tired if he has to use the switch for any lengthy periods whatever he uses. 51, BE
Review	Fairly easy for us to provide and it would give him the whole concept, anyway and then we could review it and see how that is. 21, SLT

7.3.5.1 Identification of Similarities and Differences between the Professions, Work Settings, Experience and Self-Rated Expertise

In order to investigate the similarities and differences between the professions, work settings, experience and self-rated expertise a chi-square test was performed to determine if there were statistically significant differences between the frequencies of the decision making process codes across the following range of categorical variables. The same groupings of the categorical variables were used as in the analyses above. The level of significance for all tests was $p=0.05$. As the codes Predict and Review were used very infrequently (0.4% and 0.2% respectively) they were excluded from further analysis.

1. **Difference between professions**: The test failed to indicate a significant difference between the three professions regarding their frequencies of decision making process code use, with values ranging between p=0.18 to p=0.84.

2. **Difference between work settings**: The test did not indicate a significant difference between those participants who worked in an assistive technology centre or a brain injury unit regarding their frequencies of code use, with values ranging between $p=0.22$ to $p=0.91$.

3. **Difference between experience in electronic assistive technology**: The test failed to indicate a significant difference between shorter and longer experience in EAT regarding the frequencies of code use, with values ranging between $p=0.27$ to $p=0.84$.

4. **Difference between experience in acquired brain inury:** The test failed to indicate a significant difference between shorter and longer experience in ABI regarding the frequencies of code use, with values ranging between $p=0.19$ to $p=0.66$.

5. **Difference between self-rated level of expertise**: The test indicated a significant difference between the Capable and Accomplished self-rated level of expertise and the frequency of use of the Prescribe code, where *p*=0.04. There was an increase in the amount of prescribing undertaken by those whose expertise was rated as Accomplished. The values ranged from *p*=0.33 to *p*=0.79 for the remaining codes.

Table 7.7 presents a summary of the Chi Square Tests results. Full results of the Chi Square test is available in Appendix 10.

Table 7.7: Results of the Chi Square Test Investigating the Relationship between the Frequency of Occurrence for Decision Making Codes and Profession, Order of Presentation and Participant Characteristics

Decision-Making Process Codes	Profession	Setting	EAT Experience	ABI Experience	Self-Rated Level of Expertise
	Level of significance p = 0.05				
Collect	0.52	0.91	0.60	0.51	0.79
Deduce	0.42	0.40	0.27	0.49	0.33
Interpret	0.84	0.55	0.69	0.66	0.43
Judge	0.20	0.32	0.64	0.59	0.37
Reason	0.39	0.46	0.51	0.45	0.56
Reflect	0.29	0.64	0.81	0.53	0.33
Restate	0.66	0.43	0.56	0.19	0.64
Formulate	0.52	0.36	0.56	0.56	0.44
Prescribe	0.37	0.22	0.84	0.46	0.04
Total Segments	0.18	0.56	0.74	0.56	0.43

The Cohen’s Kappa scores indicates there was a high level of agreement between the raters for all coding frameworks and the scores are as follows:

Hypothetico-deductive coding k= 0.98

Heuristics coding k= 0.99

Decision making process coding k= 0.98

7.3.6 **Patterns of Use in the Decision Making Process**

In order to examine the participants' sequential decision making processes the 11 decision making codes (Discard was excluded) were plotted on a graph in their order of occurrence within the verbal protocols. A similar concept, the Problem Behaviour Graph, has been utilised within decision making research (Jones, 1989, Greenwood and King, 1995) and seeks to plot the sequence of decision making alongside the content and time spent. In this study, the focus was upon the sequential use of the cognitive decision making codes and the resultant graphs were named Decision Process Graphs (DPG). Full details of the justification for use are provided in Section 3.7.4.2 of the Justification Chapter.

Subsequent to plotting the 11 decision making codes, the codes underwent analytical coding in order to enable patterns to emerge from the data. As with the chi-square analysis, the codes Predict and Review were excluded from this analysis in view of their very limited occurrence. The remaining nine decision making codes were reviewed in relation to their distinctiveness and relatedness to each other and were re-coded using analytical coding.

The codes Collect and Prescribe define actions which are start and end points and Formulate is an intermediate end point. The remaining six codes relate to the cognitive processes of decision making. While each code is distinctly different in its meaning and use, two overarching decision making strategies which incorporated each concept were generated, enabling the six codes to be mapped to these new codes - Infer and Deliberate. Deduce, Interpret and Judge have been analytically re-coded to Infer which is defined as "the extraction of meaning based upon individual perspective, taking into account professional propositional knowledge". On the other hand Reason, Reflect and Restate have been re-coded to Deliberate which is defined as "applying reflective and measured consideration". This makes the analysis that follows much more manageable and illuminating. The mapping process for this study is outlined in Figure 7.18.

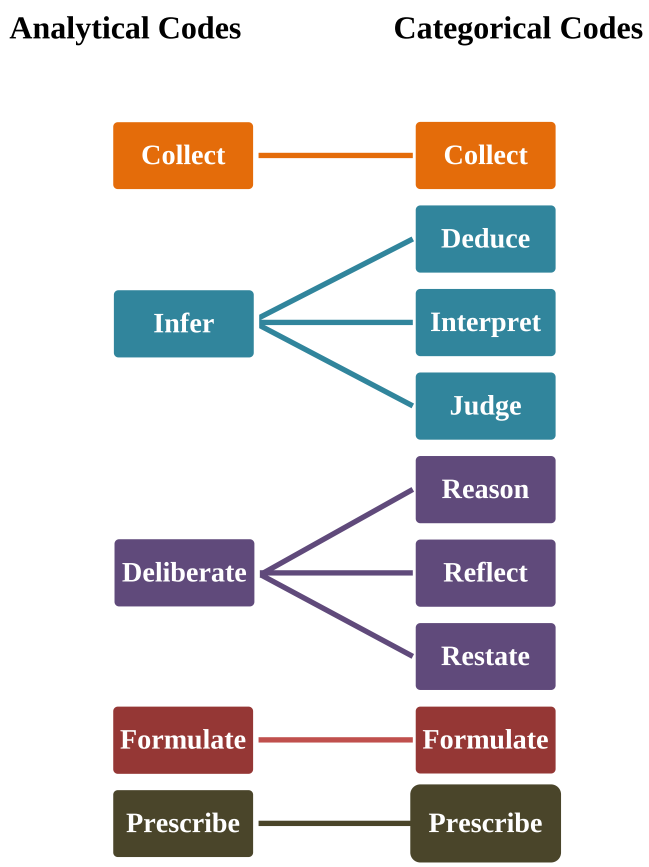


Figure 7.18: Analytical Coding of the Decision- Making Process Codes

The order in which the codes are presented in Figure 7.18 is not a fixed sequential order regarding the process of decision making. There is an apparent beginning (Collect) and an end point (Prescribe), which may come at various intervals throughout the verbal protocol or at the end. The remaining codes, Infer, Deliberate and Formulate may be variably ordered. They have been ordered within the figure based upon their typical order of appearance observed within the data.

A two-way ANOVA was conducted to examine the effect of randomisation of the case scenarios on the frequency of occurrence of the analytical decision making codes. A second ANOVA was performed on the number of total segments coded for each case scenario where p=0.382. In none of the ANOVA results were there any significant differences. The complete ANOVA results are presented in Appendix 11. Since the process to generate Decision Process Graphs (DPG) is very involved data reduction was sought. As the ANOVAs indicated that the cases did not differ significantly only one randomly selected protocol per participant was subsequently re-analysed according to the analytical coding. Decision Process Graphs were generated for 60 verbal protocols. Nine DPGs are shown later in the chapter and the remaining 51 graphs are available in Appendix 13.

7.3.6.1 Self-Reported Levels of Expertise and the Exploration of Decision Making Processes Pattern

All DPGs were examined to investigate if the level of self-reported expertise influenced the sequential use of the decision making processes. In order to facilitate examination of the data the five levels of expertise were condensed into two levels which were named Capable and Accomplished, as explained in section 7.3.3.3.

7.3.6.2 Results for Capable and Accomplished Levels of Expertise

The graphs were separated into the Capable and Accomplished categories, based upon self-reported expertise prior to visual examination. Different patterns emerged for the two groups. The Capable participants appeared to rely more on collecting information (Collect) which they subsequently used, fairly rapidly, to begin thinking of a solution (Formulate). This pattern was then repeated and Collect, Formulate, Collect, Formulate dominated the Capable group graphs. In contrast, the Accomplished group appeared to Collect less, make more use of Infer and Deliberate, with less reliance on Formulate and more use of Prescribe. However, the results need to be interpreted with caution as the participant sample was skewed towards Accomplished participants (*n* = 40) as opposed to Capable (n=20) participants.

The following two graphs, Figure 7.19 and 7.20 illustrate the pattern observed for the Capable and Accomplished categories. Each point on the graph is a coded segment of the verbal protocol and it is this which is the focus of these graphs. The dashed lines between the points do not indicate continuous data but are there to assist with viewing the order of the segments. In Figure 7.19 the Collect, Formulate, Collect, Formulate pattern is apparent and has been highlighted by a rectangle.

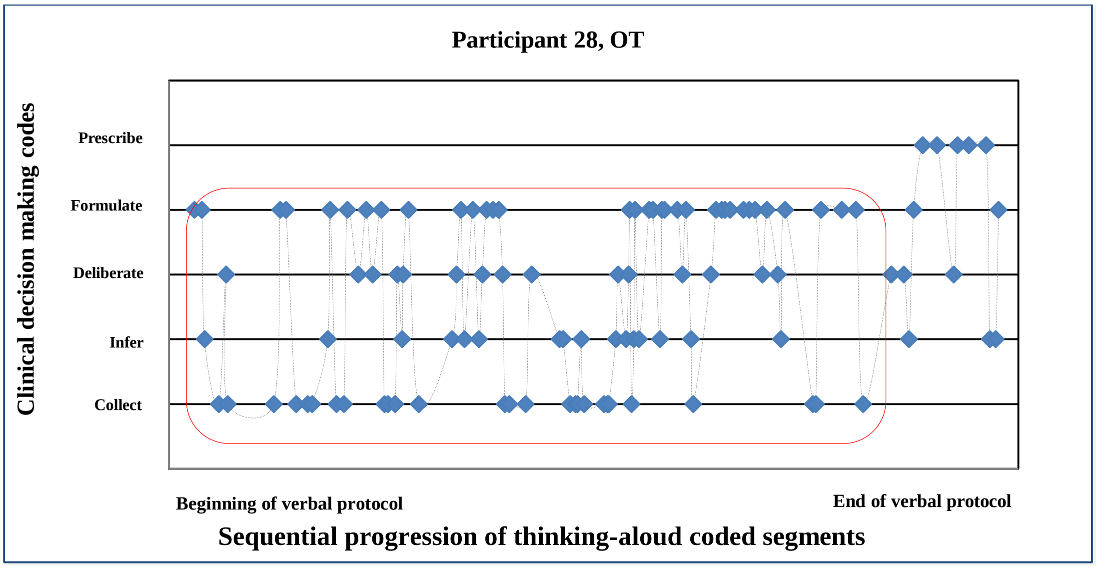


Figure 7.19: Decision Making Process Graph of a Capable Participant

Figure 7.20 below presents the graph of an Accomplished participant and a different pattern is observable. There is a stepwise progression towards Formulate and Prescribe which is noticeably different from the rectangle shape of the Capable participant, in this case highlighted by three rectangles.

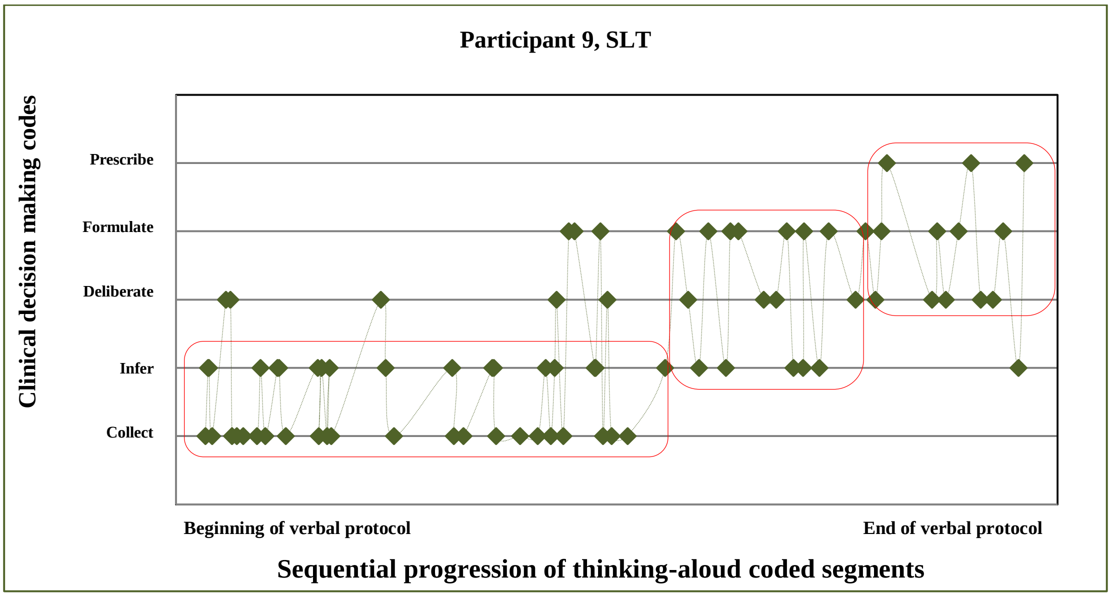


Figure 7.20: Decision Making Process Graph of an Accomplished Participant

7.3.6.3 Discriminant Analysis of Capable and Accomplished Categorisation

Discriminant analysis was carried out to investigate whether the use of the two categories Capable and Accomplished was able to predict group membership with respect to the use of the five CDM codes. The results indicated that 60 % of the participants were correctly classified as Capable and 63% as Accomplished according to their original self-rating. Table 7.8 outlines the classification results.

Table 7.8: Discriminant Analysis Results for Capable and Accomplished Classification. The figures in bold indicate agreement between the actual and predicted group membership. Overall 62% of the participants were correctly classified.

Actual classification based upon self-rated expertise (n=60)		Predicted Group Membership (n=60)		Predicted Group Membership %	
Capable	**Accomplished**	**Capable**	**Accomplished**	**Capable**	**Accomplished**
20	40	**12**	8	**60**	40
		15	**25**	37.5	**62.5**

7.3.6.4 Discriminant Analysis of the Capable, Skilled and Accomplished Categorisation

During visual examination of the DPGs a third category seemed to emerge which had a distinctly different pattern from either the Capable or Accomplished classification. A number of graphs demonstrated an intermediate stage which appeared to be a transition in the use of the decision making processes from the Capable to the Accomplished pattern. In order to investigate if such a group corresponded to the participant's self-ratings, an alternative categorisation of expertise level was developed. The new categories were:

1. **Capable**: comprised from the Beginner and Advanced Beginner categories; *n*=8
2. **Skilled**: comprised from the Competent and Proficient categories; *n*=32
3. **Accomplished**: comprised from the Expert category; *n*=20

The Capable category patterns retained the same features as before where the predominant pattern was one of Collect, Formulate, Collect, Formulate and eventually Prescribe. They used Collect and Formulate more than the Skilled and Accomplished participants.

The Skilled category still relied upon Collect throughout the verbal protocol but used the Infer and Deliberate process more frequently and generally before Formulate and eventually Prescribe. They used Collect as often as Capable participants but used Infer and Deliberate more than Accomplished participants.

The Accomplished category retained the same pattern features as before and appeared to Collect less and typically not for the duration of the protocol and make similar use of Infer and Deliberate as the participants in the Skilled category but with less reliance on Formulate and more use of Prescribe.

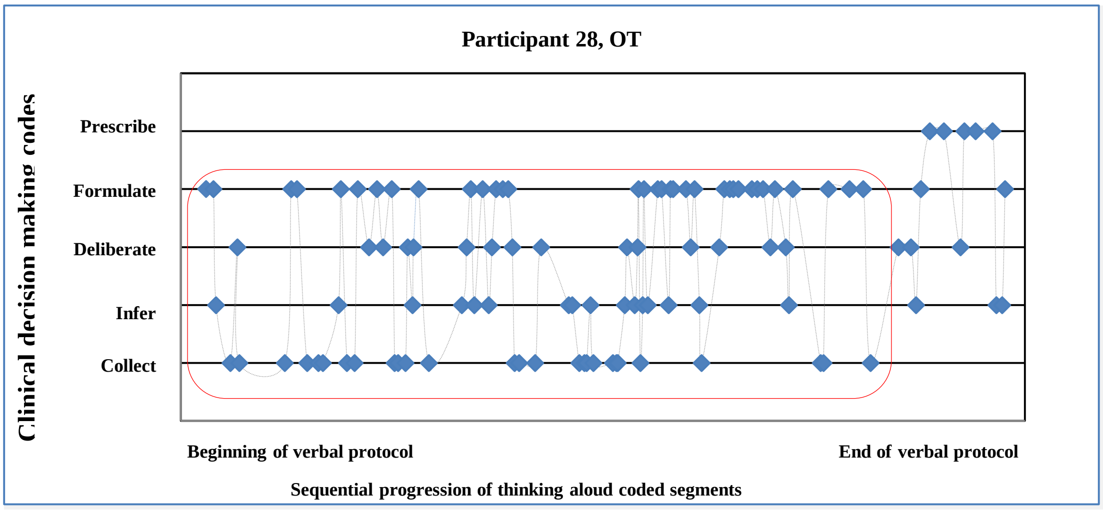
Discriminant analysis was carried out to investigate how accurately this revised categorisation was able to predict group membership.

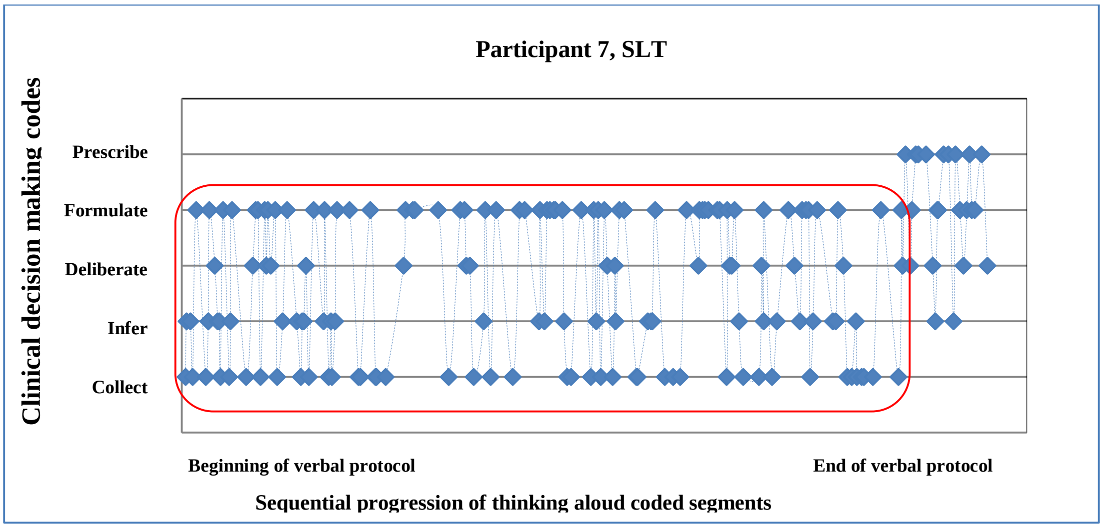
The results indicated that 63% of the participants were correctly classified as Capable, 41% as Skilled and 55% as accomplished, according to this revised categorisation. The revised Capable grouping at 63% was a slight improvement upon the former Capable category but the revised Accomplished category at 55% was worse than the former Accomplished category. There was no clear separation between the three groups which is illustrative of 48% overall correct grouping. Table 7.9 below presents the full results.

Table 7.9: Discriminant Analysis Results for Capable, Skilled and Accomplished Classification. The figures in bold indicate agreement between the actual and predicted group membership. Overall 48% of the participants were correctly classified.

Actual classification based upon self-rated expertise (n=60)			Predicted Group Membership (n=60)			Predicted Group Membership %		
Capable	**Skilled**	**Accomplished**	**Capable**	**Skilled**	**Accomplished**	**Capable**	**Skilled**	**Accomplished**
8	32	20	**5**	1	2	**62.5**	12.5	25
			9	**13**	10	28	**41**	31
			4	5	**11**	20	25	**55**

Figures 7.21 to 7.23 show the different observable patterns between the three categories of expertise. The different patterns within each are identified by rectangles.





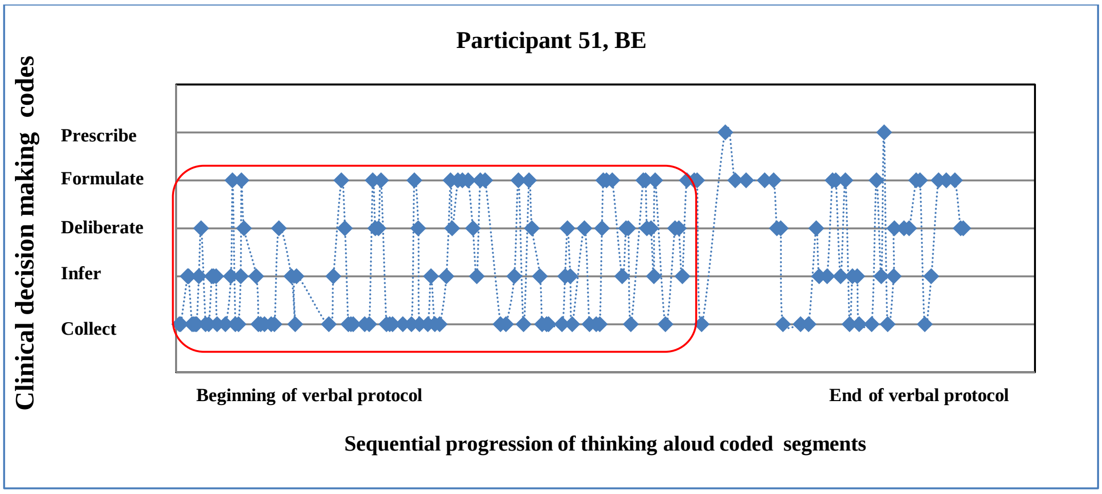
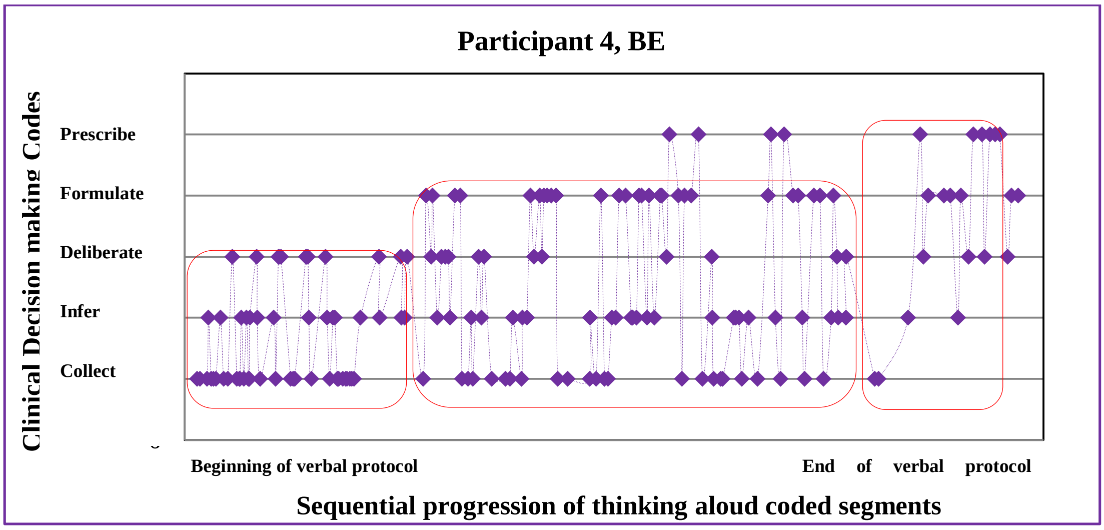
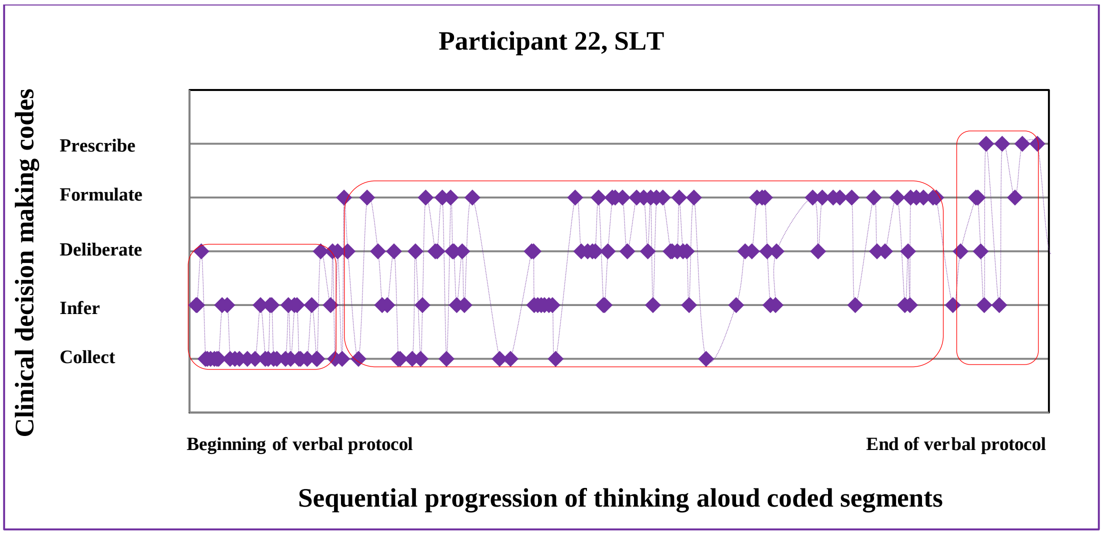


Figure 7.21: Decision Process Graphs for the Capable Classification





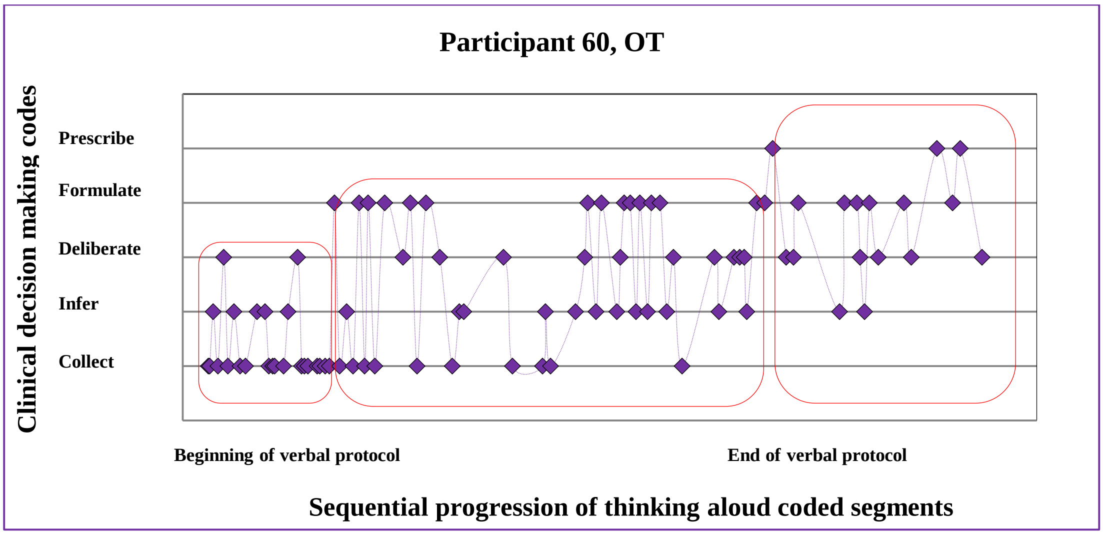
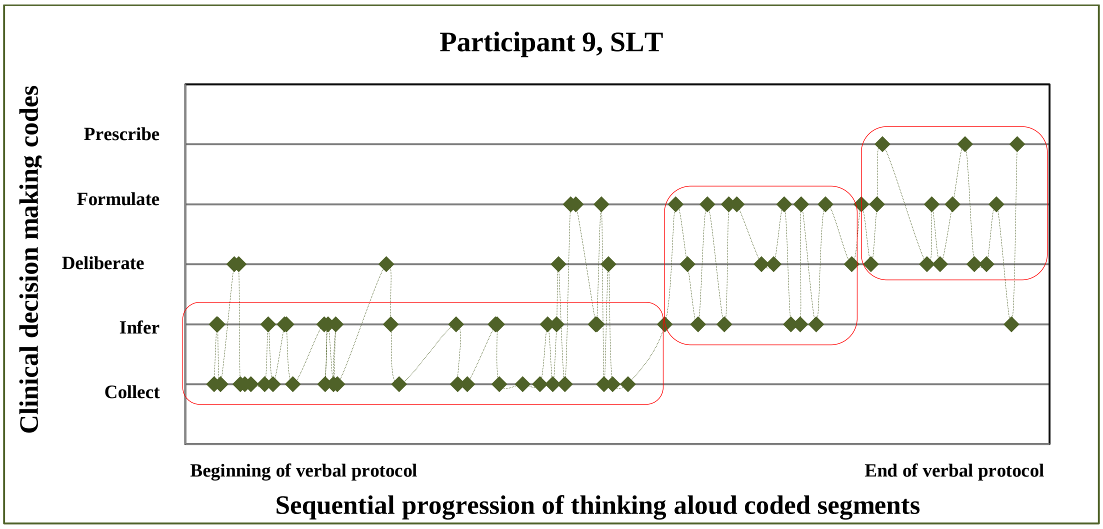
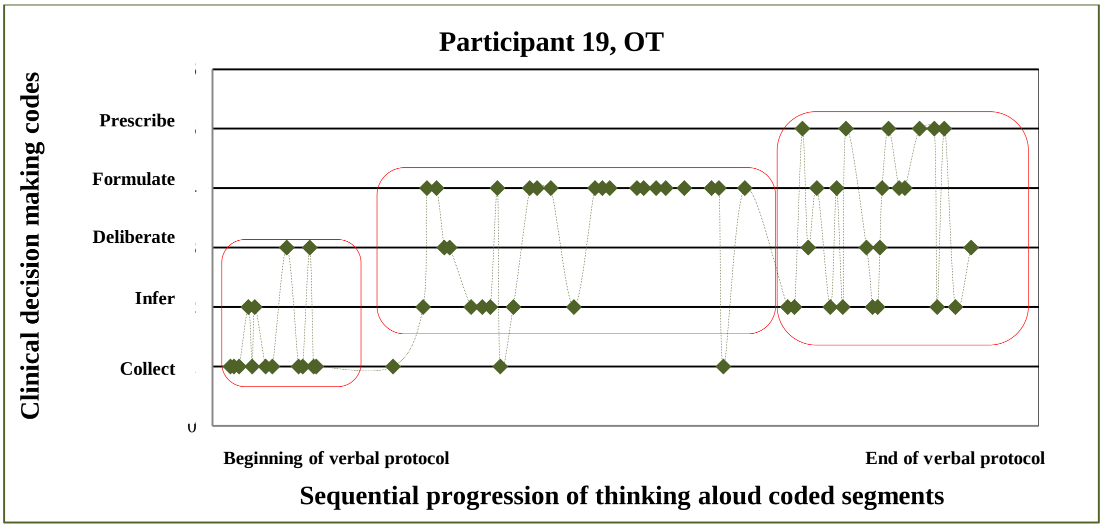


Figure 7.22: Decision Process Graph for the Skilled Classification





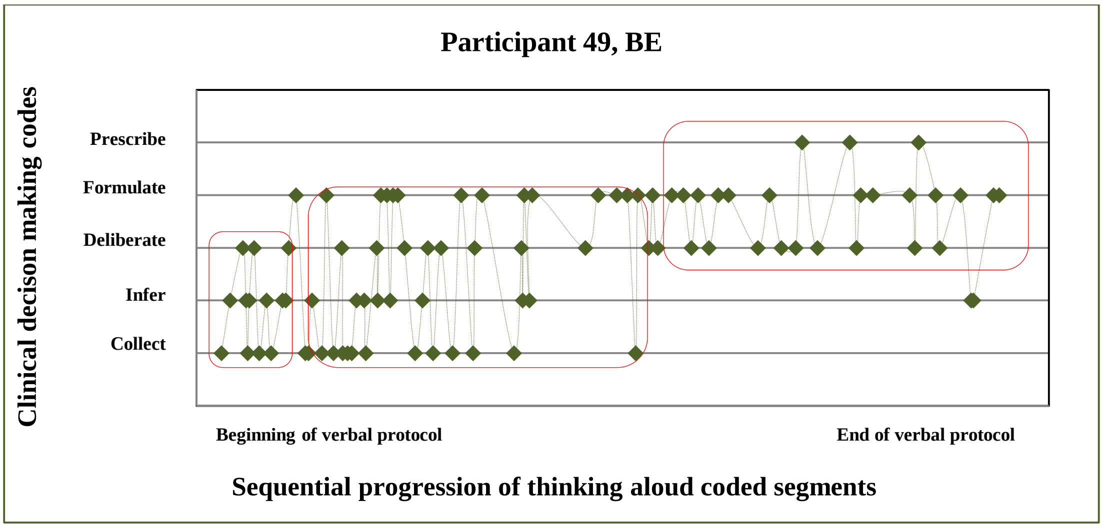


Figure 7.23: Decision Process Graph for the Accomplished Classification

7.3.6.5 Discriminant Analysis of Visual Pattern Identification for Expertise Categorisation

As the Capable, Skilled and Accomplished grouping was a poor predictor of categorisation a third classification was explored. However, it was not dependent upon the participants' self-rating but upon the patterns as visually observed within the graphs by the researcher. This classification was called the Visual Pattern Identification for Expertise. These patterns were based on a composite of the work by Elstein et al. (1978) and (Elstein and Schwartz, 2000) in terms of the order and usage of the decision making processes.

This new categorisation, where all participants were assigned to a category without reference to their self-rating results was created solely by visual examination of the graphs using CDM theory. The same decision making characteristics which were observed in the Capable, Skilled and Accomplished categories described in the previous section were used to allocate each participant to a category.

The categories were thus populated as follows:

1. **Capable**: *n*=12
2. **Skilled**: *n*=26
3. **Accomplished**: *n*=22

Discriminant analysis was carried out to investigate how accurately this revised categorisation was able to predict group membership. The results indicated that overall 77% of the participants were correctly classified based upon the Visual Pattern Identification categorisation. Table 7.10 presents the discriminant analysis results in further detail and Figure 7.24 illustrates the results of the canonical distribution map of the groups.

Table 7.10: Discriminant Analysis Results for Visual Pattern Identification for Expertise Classification. The figures in bold indicate agreement between the actual and predicted group membership. Overall 77% of the participants were correctly classified.

Actual classification based upon Visual pattern identification of expertise (n=60)			**Predicted Group Membership (n=60)**			**Predicted Group Membership %**		
Capable	**Skilled**	**Accomplished**	**Capable**	**Skilled**	**Accomplished**	**Capable**	**Skilled**	**Accomplished**
12	26	22	**9**	1	2	**75**	8	17
			4	**20**	2	15	**77**	8
			4	1	**17**	18	5	**77**

.

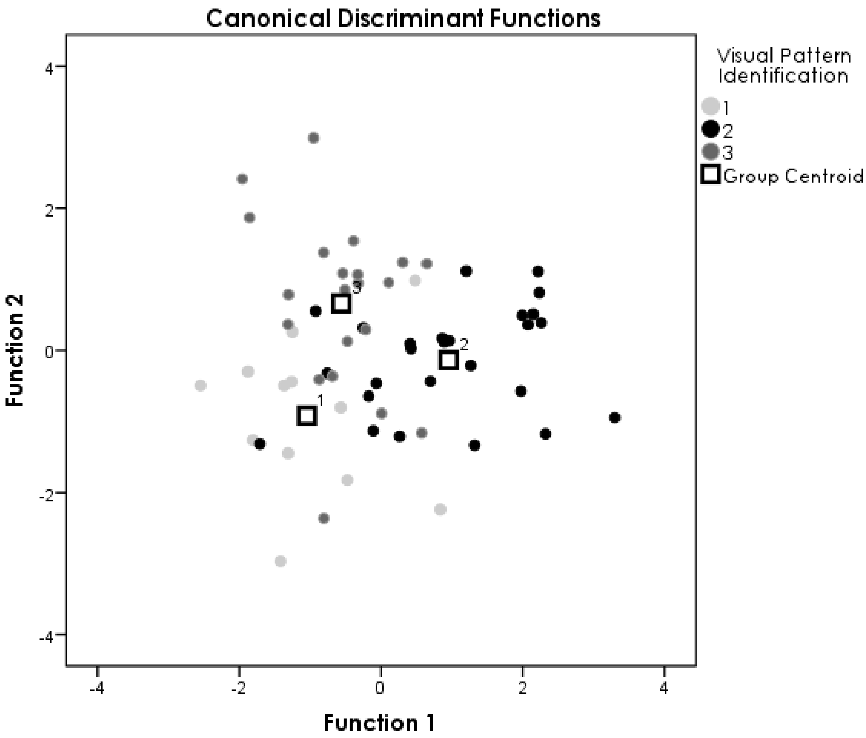


Figure 7.24: Canonical Discriminant Analysis for Visual Pattern Identification Classification Demonstrating the Emergence of Three Distinct Groups

Group 1 is Capable, Group 2 is Skilled and Group 3 is Accomplished

The emergence of three distinct groups can be seen in the above figure suggesting that it may be possible to identify patterns used during the process of decision making which may be associated with differing levels of expertise. These levels of expertise tie in with studies such as those by Elstein and Schwartz (2000) and Norman (2006). They also confirm that self-rating levels of expertise are potentially poor and that the number of years of experience are often unrelated to this understanding of level of expertise.

7.4 Conclusions

This is the first study which has investigated the content and process of clinical decision making of BEs, OTs and SLTs within the assessment for EAT. The sample population (*n*=60; BE, *n*=20; OT, *n*=20; SLT, *n*=20) was the same as for Study 1 and detailed in Chapter 5, Section 5.6.

Two overarching themes were derived from the data, **Person** and **Equipment,** which detailed the **content of clinical decision making** by all professions. Each theme was comprised from three concepts as follows:

Person

i. Health
ii. Personhood
iii. Physical Ability

Equipment

i. Identification of need
ii. Equipment Solutions
iii. Implementation of technology

There was a high degree of similarity observed in the content between the professions and although all professions raised all codes, there were a small number of profession-specific differences. Overall, the BEs and SLTs provided greater detail than the OTs in relation to the Equipment theme, detailing the specification and configuration of the technology.

The BEs reported on the technical and safety implications of the technology to a greater extent than either the OTs or SLTs which was apparent within the topics **wheelchair configuration and control, EC configuration and risk management** and categories **identification of EC needs, integrated or separate, maintenance and technical support of equipment** and **wheelchair mounting**.

The OTs provided greater detail than the BEs and SLTs when considering the topics **cognition** and **wheelchair positioning.**

Profession-specific differences were also observed by the SLTs proving greater detail than the BEs and OTs on communication-related aspects of assessment and provision such as **functional communication, adjustment and acceptance, communication aid specification, communication aid configuration, low-tech communication aid, training and teamwork.**

Analysis of the **process of decision making** also displayed a high degree of similarity between the professions. Differences were observed across the professions in relation to an increase in **hypothesis generation** (hypothetico-deductive code) and the use of **prescribe** (decision making process code). Participants with experience in EAT of 10 or more years generated more hypotheses during the decision making task and participants who self-rated their level of expertise as proficient or expert arrived at a prescription the most frequently.

Application of the theoretical models of decision making indicated that an enhanced version of the hypothetico-deductive model of decision making was utilised by the participants. The enhanced model incorporated two additional stages, **cue implication** and **hypothesis implementation** and nine different configurations of the stages were observed. The most frequently employed configuration included the four stages of the hypothetico-deductive model in addition to cue implication used in a variable and non-linear manner.

Heuristics were used less frequently than the enhanced hypothetico-deductive model by all professions and were utilised most by the SLTs. The most frequently employed heuristic, **representativeness**, also known as pattern recognition, was used by all professions and no difference was observed dependent upon level of expertise.

Patterns were observed in the use of the decision making process codes according to level of expertise and Decision Process Graphs were generated. Three distinct groups emerged from the data which suggests that it is possible to identify patterns used during the process of decision making which may be associated with differing levels of expertise.

7.5 Chapter Summary

This chapter presented the results of Study 2, which investigated the content and process of decision making during the assessment for EAT. Implications of the results will be discussed in the following chapter.

Chapter 8

Discussion, Recommendations for Future Research and Conclusions

8.1 Introduction

This is a first study investigating the factors that inform the clinical decision making process in three professions involved in the prescription of EAT. There is limited research in this area and this study takes an important step forward in furthering the CDM knowledge. As there is a single discussion chapter for the two studies undertaken some new literature has been included where appropriate but it has been kept to a minimum.

Each of the key findings listed below will be discussed in turn. The application to clinical practice will be addressed throughout the chapter. Recommendations for future research in order to extend and apply the findings within service design and clinical practice conclude the chapter.

The key findings:

i. An enhanced version of the hypothetico-deductive model of decision making was derived from the data, which may be suitable for the CDM related to complex disabilities;
ii. The decision making of all professions was congruent with the dual-process theory;
iii. There are both similarities and differences between the professions in their reported areas of specialist knowledge and perceptions of their role;
iv. A high degree of similarity exists in the content and process of decision making between the professions;
v. The process of decision making seems to differ based upon level of expertise;
vi. The mixed methods design was successful in investigating the aims of this research.

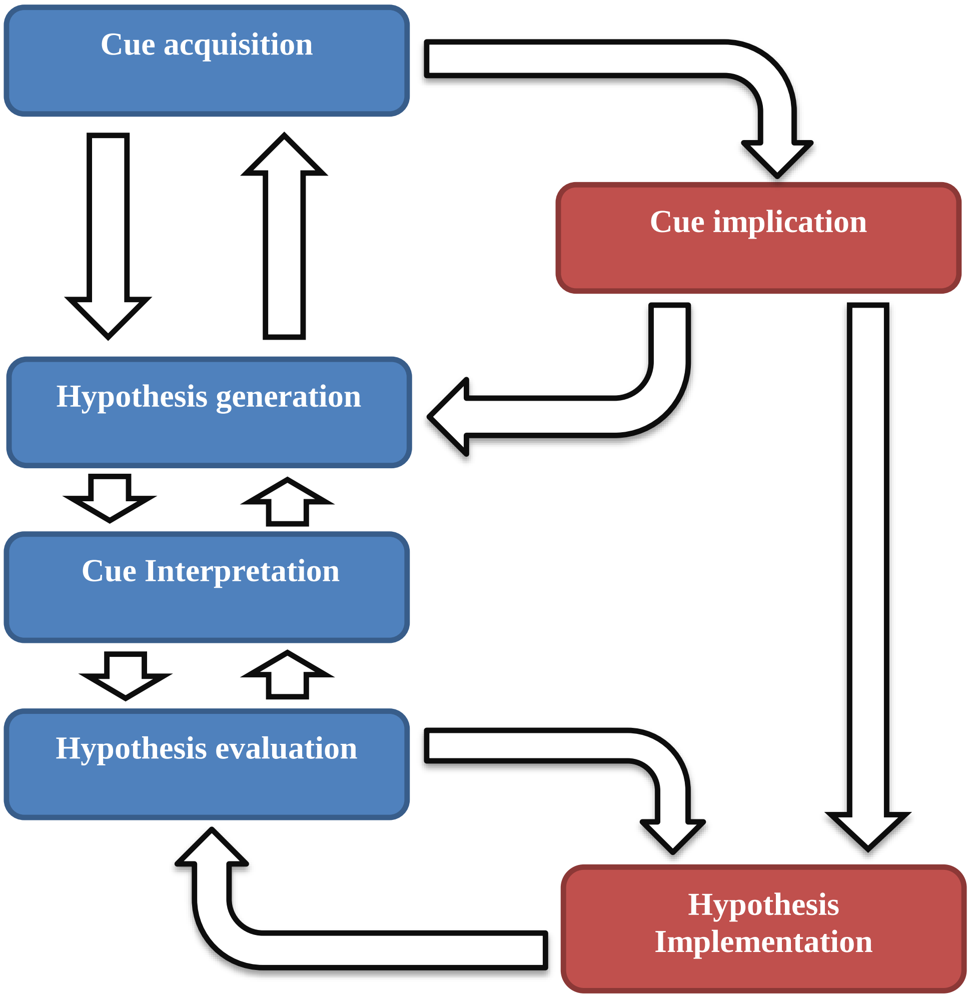
8.2 Model of Decision Making Potentially Suitable for Complex Disabilities

Provision of assistive technology is most often required for people with long term and often complex conditions and consequent disability. The AT provided needs to be matched to the physical, social and psychological needs of the recipient, if it is to be useful and acceptable. Research to date suggests that abandonment of AT is common (Phillips and Zhao, 1993, Scherer et al., 2005, Verza et al., 2006) and in order to combat this decision making that precedes provision needs to take all these aspects into account. This differs from many studies addressing decision making which have focused on diagnosis (Croskerry, 2009b, Terry et al., 2007, Skaner et al., 2005, Elstein et al., 1993). More recent work, as reported in Chapter 2, Section 2.3.2.1 has, however begun to explore decision making beyond diagnosis and to identify the factors involved in implementation and management. Assessment for and provision of EAT is situated within the social model of disability which focuses upon the interaction between the individual's biological, psychological and social status.

This study shows clear evidence of most participants taking account of the full range of needs of the clients. Results from this study indicated that many factors were being considered during the process of decision making and participants, for example, reported taking account of the appropriateness of: the relationship between being a teenager and wanting equipment which had "street cred", equipment that was not perceived as disabling (Lupton and Seymour, 2000) and the psychological impact of being able to communicate in relation to self-esteem (Hickey and Saunders, 2010). None of the current decision making models within healthcare incorporated such factors with relatively little attention paid to the psychosocial aspects. Thus two additional stages, Cue Implication and Hypotheses Implementation, were added to the Elstein (1978) medical decision making model to reflect the research findings. These findings tended to incorporate material that extended beyond the medical symptoms and took into consideration the psychosocial impact. The two additional stages derived from the data are presented in an enhanced model of decision making (termed here the Enhanced model of hypothetico-deductive decision making) which embedded multi-professional decision making about a complex disability and is presented in Figure 8.1. While further testing of the model is required to confirm its relevance in a range of chronic conditions the enhanced hypothetico-deductive model provided a framework within which the 11 cognitive decision making process codes derived from the data were situated. Further research would be required to further develop this preliminary mapping but several important observations can be made from this exploratory attempt.

i. There is no theoretical conflict between the 11 cognitive decision making process codes and the Enhanced model;
ii. The codes provide further detail regarding the cognitive processes undertaken during all stages of the Enhanced model;

Stages in original Elstein model **Stages derived from study data**



Key:

Blue: Hypothetico-Deductive Model, Elstein et al., (1978)

Red: The additional stages derived from the data

Figure 8.1. Enhancement of the Hypothetico-Deductive Model: a Model of Clinical Decision Making Potentially Suitable for Assessment of Complex Disabilities

The findings derived from this study’s data display similarities to existing information-processing models of decision making (Elstein et al., 1978, Carnevali, 1984, Carroll and Johnson, 1990) but no model incorporated both of the additional stages derived from the present data. Carnevali (1984) focus on such information as the individual’s demographic data were also considered within the Cue Implication stage of the model derived from this study’s data. However although similarities exist with the model derived from this study in relation to the increased emphasis on personal factors, Carnevali’s model is for diagnostic decision making and therefore has limited application within EAT.

The Carroll and Johnson (1990) framework is suitable for situations where the decision making task or clinical problem is unspecified or ill-structured and identification of the problem is required first. This is generally not the case within the assessment for EAT where it is evident that the individual may require an assistive device. However, the stages “action” and “feedback” within their framework alongside the dynamic process of decision making closely correspond with the Hypotheses Implementation stage in the current model. The impact of the disability which may affect family and friends in addition to the affected individual were issues which were addressed within the Cue Implication and Hypotheses Implementation stages of the current model. As with community nursing, assessment of an individual for EAT is a dynamic, continuous process and not a one-time event (McIntosh, 2006). The Carroll & Johnson (1990) model was considered to be an appropriate conceptual framework for decision making within community nursing as it facilitated examination of the complete process of assessment (Bryans et al., 1996) and successful empirical application was reported by Kennedy (2002). However, it would be incomplete for the EAT field as the use of decision analysis as a method for selecting the best outcome is inappropriate in this case and more suited to diagnosis, as it excludes the consideration that should be given to the individual’s environment.

The framework employed within midwifery, The International Confederation of Midwives—Midwifery Framework (Jefford et al., 2011) has features which are compatible with assessment within EAT but ultimately it has limited application. As in midwifery, contextual factors and the service user's emotional status were considered (within the Cue Implication stage) and decision making in collaboration with the service user is a feature of clinical practice in EAT. However, the power relationship of the decision-maker is likely to differ from midwifery. Within complex disability and EAT assessment it may be that the service user's decision making abilities have been compromised by cognitive difficulties or their presenting condition and consequently the power shifts to the clinician. In contrast, within midwifery, the woman usually has no pathology which may impact her decision making and she is therefore perceived as being capable of making autonomous decisions.

The closest correspondence to the model of decision making employed within EAT was found within psychiatric medicine (Bhugra et al., 2011) and the underlying theoretical framework within psychiatry, like for EAT, is the biopsychosocial model. In their study they explored how clinicians balanced the biological, psychological and social factors during diagnostic decision making and management and analysis of their retrospective reports concluded that they employed a combination of the hypothetico-deductive approach and heuristics, utilising the dual-theory approach to decision making. Many of the issues which they raised as contributing towards the complex nature of decision making parallel those within EAT. These included: integration of information from multiple sources, balancing the biological, psychological and social factors, building a picture of the individual utilising many layers of information, the influence of societal pressures, cost and the need for ongoing refinement of the initial hypothesis. A limitation of the study was the retrospective nature of the reporting which might reduce the veracity of the findings. Further research would be required to investigate whether either the Cue Implication or Hypotheses Implementation stages were employed in the decision making process.

Understanding the decision making process for EAT can help provide a meaningful framework for decision making in clinical practice and as part of pre- and post-registration education and training. Within clinical practice, while diagnosis or, in the case of EAT, identification of the most appropriate technology prescription, is important, the decision making related to the implementation of provision of EAT is also important. As reported in Chapter 1, Section 1.4 a number of factors influence the potential disuse of AT and include social acceptability, training and review of use. Such factors were addressed by the participants throughout their decision making, particularly within the Cue Implication and Hypotheses Implementation stages of the process. These two additional stages indicate that the participants were weighing the significance of the wider external factors prior to formulating a technology prescription and they were aware of the importance of the successful implementation of the prescribed devices. It is proposed that the enhanced model of decision making derived from this study may be suitable for decision making within complex disability as it enables the clinician to extend beyond diagnosis and consider the implications of such important multi-factorial needs and their impact upon implementation of the technology.

8.3 Decision Making was Congruent with the Dual-Process Theory of Decision Making

Evidence for the dual-process approach to decision making (Stanovich, 1999, Evans, 2008) was apparent in the verbal protocol data of participants from all professions. These are the first reported findings of the decision making process in both biomedical engineering and speech and language therapy and contribute considerably to the existing knowledge within occupational therapy. This part of the discussion will focus on the following key aspects:

i. The nature and role of dual-process theories within clinical decision making and this study;
ii. Correspondence in findings between this study and those in the OT literature;
iii. Application to education and clinical practice.

Over three-quarters of participants demonstrated the combined use of an intuitive (System 1) and analytical (System 2) approach to thinking, consistent with the dual-process theory. The analytical approach (hypothetico-deductive processing) was employed the most frequently and this may reflect typical practice among the professions under investigation within EAT. However, as the data was not exhaustively examined for all possible heuristics, with only three commonly occurring being addressed (Tversky and Kahneman, 1974) Given this limitation, it may be that the use of the intuitive approach is greater than reported in Chapter 2, Section 2.3.2.2. An alternative explanation which would require further investigation, is the extent to which the use of thinking-aloud or enhanced case scenarios influenced the use of an analytical or an intuitive approach. For instance, intuitive approaches have been found to be commonly used in clinical practice when time is constrained (Croskerry, 2009b) and as this was not the case during the thinking-aloud task, they may have been employed less than in clinical practice.

Within this study, the use of heuristics occasionally resulted in incorrect assumptions upon which decisions were initially predicated; for example, the anchoring and adjustment heuristic was particularly evident within case scenario 1 when participants assumed a lifestyle and social environment based upon the cause of the brain injury and in certain cases the impact of recent training was apparent within the availability heuristic. When the use of a heuristic resulted in a cognitive error the parallel use of the hypothetico-deductive approach enabled participants to seek clarification prior to their final prescription. This checking mechanism and its use within this study enabled appropriate technology prescriptions.

As noted in Chapter 2, Section 2.4 clinical reasoning research in occupational therapy has not clearly delineated the process of reasoning from the influencing factors which may impact the therapist's thinking process and ultimately its content. However, findings from the Hagedorn (1996) and Roberts (1996b) studies indicate important similarities between their findings and those in this study in that Hagedorn (1996) showed that the process of reasoning was non-sequential and the hypothetico-deductive stages were employed in variable order and in the Roberts (1996b) study the hypothetico-deductive approach was employed and was extended to include an additional stage incorporating management and not all stages were employed by all participants. Their additional stage of management equates to Hypotheses Implementation in the enhanced model derived from this study and as the clinical population within these studies included physical rehabilitation, mental health and disorders seen within social services, it suggests that the enhanced model has applications wider than the field of EAT, as proposed.

Within the current study, the nine combinations of the six stages which were employed by the participants (see Chapter 7, Section 7.3.4.7) all resulted in a prescription for technology. Hypothesis Evaluation was not utilised in five out the nine combinations which is surprising as within Elstein's (1978) model it is this process which is responsible for diagnosis and where the clinician makes a judgement between competing diagnoses. Applied to EAT, this would be where the final prescription is determined. In four out of the five combinations, Cue Implication was utilised and it may be an explanation that within complex disability, this stage acts as a filter prior to Hypothesis Generation which may then represent the end point of the decision task. Further research would be required to investigate this preliminary explanation. It would also be important to investigate whether the quality of the decision is affected by the inclusion or exclusion of different stages and in what ways this can affect the final outcome. As this study was not investigating the quality of the prescription, (and participants were explicitly told this) it is not possible to form any conclusions about this.

As noted in Chapter 2, Section 2.5 the acquisition and development of clinical reasoning and decision making skills is an integral aspect of clinical practice in healthcare in addition to understanding how to become more effective at decision making. This study is helpful in illustrating the need for reflective practice, professional supervision and case discussion in order to provide a forum for exploring individual and group clinical reasoning and raise awareness of the impact of the types of cognitive errors reported by Croskerry and Nimmo (2011).

8.4 Similarities and Differences in Decision Making Between the Professions

8.4.1 Specialist Knowledge and Role

Each profession identified an area or areas of specialist knowledge specific to their profession which were recognised and valued by all professions as shown in the content results in Study 2. There was a substantial degree of shared knowledge among the professions which may be reflective of an increase in inter-professional learning at pre- and post-registration level or an outcome of working in an inter- or multi-disciplinary team. Additionally, integration can be observed in the development of post-graduate qualifications in assistive technology and the increasing use of Assistive Technologist as a job designation.

The participant's report of their role also indicated a sharing at a functional level with recognition that specific roles were held by individual professions. Such roles were viewed as a product of that profession's specialist knowledge and were integral to the assessment process. All professions were insistent on the need for joint assessment, collaborative working and joint decision making in clinical practice, in order to ensure optimum practice which concurs with Muller's (2012) opinion, where he states that "no one person or profession" can address all the factors and affirms the need for a multidisciplinary approach. During the debriefing interview at the end of the data collection session, participants, particularly those from the assistive technology centres where the full team is typically on the same site, reported that during the trial it felt unfamiliar to undertake decision making and prescription without discussion with colleagues or the use of their team's structured format for assessment.

The results show how these professions work together in a complementary manner in the assessment and provision of EAT and their awareness of each other's specialist knowledge and role is helpful in providing an holistic service and best possible outcome for the patient. There is a focus on ensuring functional independence for the service user by all professions.

Two key implications arise from these findings which would be valuable for the provision of EAT to be investigated further:

i. Is there a difference in the quality of the prescription and outcomes within EAT when assessment is undertaken by a specialist multi-disciplinary team rather than specialist single professionals collaborating as required?

As reported in Chapter 1, Section 1.4 the structure and team composition of those offering EAT assessment and prescription differs throughout England. Within the increasingly pressurised and financially-constrained NHS there is, arguably, the risk that professional collaboration may not occur as often as clinically necessary. The Department of Health guidance for augmentative and alternative communication (AAC) services and environmental control provision (EC) (Department of Health, 2010) outlines the team composition for each area. Recommendations include the need for a specialist team for EC and AAC provision and close professional collaboration. The benefits of a multi-disciplinary approach within the provision of rehabilitation services was advocated by Barnes (1999) whereby he asserted that within rehabilitation medicine there must be active collaboration between the healthcare team and the patient for treatment to be of use. He also made the point that any intervention extends beyond the physical symptoms to include the psychological consequences and the social context of the individual. A recent Cochrane review concluded that multi-disciplinary rehabilitation by expert neurological rehabilitation services does improve outcomes after acute brain injury in adults of working age (Turner-Stokes et al., 2011). It could be argued that there is a high degree of overlap between the Turner-Stokes et al. study and the provision of EAT for people with an acquired brain injury as the need for specialist multidisciplinary input also applies. However, such research evidence does not yet exist for EAT. Further research is required to explore team compositions and investigate the relationship of various organisational frameworks on the outcomes of EAT provision.

ii. Does a specialist multi-disciplinary team structure promote innovative thinking or is there the risk of conforming to organisational thinking when making decisions?

The comments from participants based within ATCs regarding the use of organisational frameworks for assessment and prescription may suggest that they are working to an agreed clinical pathway, possibly based, for example, on the available research evidence, clinical expertise and constraints imposed upon service delivery. Whilst this could potentially be considered good practice, further research is required to investigate if a specialist multi-disciplinary team structure promotes innovative thinking during decision making or is there the risk of conforming to organisational thinking. A positive aspect of working within a specialist multi-disciplinary team may be the "culture of practice" (Smith et al., 2007) demonstrated by senior staff which can assist with supporting less experienced staff. It can also facilitate clinical discussion which can produce innovative thinking and it has the potential to generate creative and novel solutions resulting from the diversity of perspectives which may have a clinical benefit for the service users. Conversely, it can also reduce innovative thinking and facilitate a reduction in novel decision making as individuals' "piggy-back" upon others' decisions and groupthink becomes the dominant model for decision making (Janis, 1972). When an individual makes a decision it appears that their reasoning process is influenced by a range of factors including their social, organisational and professional contexts, their personal beliefs, and their expectations regarding possible outcomes as has been observed in previous studies (Chapparo and Ranka, 2008, Higgs et al., 2008). Further research is required in order to investigate the influence of multidisciplinary decision making within EAT on technology prescriptions and patient outcomes.

8.4.2 Content of Decision Making

A high degree of similarity was observed within the content of decision making between all professions during the think-aloud task, which would suggest that they are working from an internalised framework for assessment and prescription. The two themes, Person and Equipment, derived from the data demonstrate close correspondence to the existing literature for AT assessment and to the dominant model of AT assessment, The Matching Person and Technology Model (Scherer and Craddock, 2002), as is detailed below.

i. The theme Person reflects the biopsychosocial perspective of illness (Engel, 1977) and the anticipated outcomes in the process of rehabilitation (Mermis, 2005).

As noted earlier, the biopsychosocial model, the conceptual underpinning for the International Classification of Functioning, Disability and Health (WHO, 2001), posits that the interaction of biological, psychological and social processes determines an individual's state of health and is particularly relevant within the field of disability as it ensures that the individual is not viewed as separate from their cultural and social context but recognises the importance of the interdependent relationship. Within this study all professions have adopted this model of health and focus upon the impact of the disability rather than focus on the illness, which can be observed throughout the content data. This approach concurs with models of assessment for AT described in the literature (see Chapter 2 for models) and is foundational to the (international) process model of assessment proposed by Federici et al. (2012).

The second component of this theme, outcome domains within rehabilitation, reflects the holistic nature of assessment undertaken by the participants for each case scenario. There is an evident correspondence with the Mermis (2005) taxonomy for rehabilitation outcome as reported in Chapter 3, Section 3.6.6.3 in relation to the topics derived from the data. Such an approach is well-suited to EAT where the outcome of intervention is dependent upon the integration of abilities within the biological, psychological and social domains.

ii. The theme Equipment reflects the literature regarding factors to consider when assessing for and implementing assistive technology provision (Cook et al., 2008, Fuhrer et al., 2003, Hoppestad, 2006, Scherer, 2004, Scherer and Craddock, 2002)

As noted within section 2.2, there is no single standardised assessment for EAT and it is likely therefore that the participants are utilising components from a number of approaches. For example, local care pathways have been developed by a number of assistive technology centres which may have had an effect upon the similarity between professions (see Appendix 14 for concrete example).

In this study, all of those areas, except research and development, identified by Enderby et al. (2013) and reported in Chapter 1, Section 1.4 regarding effective AAC provision were addressed by the participants which would suggest that the findings concur with recommended best practice.

8.4.3 **Process of Decision Making**

As with the content of decision making, a high degree of similarity exists in the process of decision making between the professions. Differences (although not statistically significant) were observed between the frequency of use of the various stages of the enhanced hypothetico-deductive model by the professions where the SLTs frequently generated the greatest number and the BEs the least. SLTs also employed the greatest number of heuristics and the OTs the least but again, the findings were not statistically significant. Although SLTs employed a greater number of heuristics there was no statistically significant difference in the number of codes generated in any of the coding procedures according to profession. Such differences did not appear to impact the final prescription, which was similar across professions. It is worth remembering that the final prescription arrived at was generic (ie type of AT rather than make and model) and the participants were specifically told the end point was not being sought.

The innovative representation of verbal data enabled further interrogation of the process of decision making with the development of Decision Process Graphs (DPG). These graphs successfully displayed the sequential process of decision making. The distinctive repetitive patterns of data collection to generation of hypotheses, which emerged within these graphs, correspond to known characteristics of expertise development (Dreyfus and Dreyfus, 2009). Elstein and Schwartz (2000) theorised that novice and intermediate medical professionals employ an information-processing approach to decision making whereby they generate a number of hypotheses and return to the data to gather information to assist in refining their hypothesis in a process of backward reasoning. The establishment of the three categories of expertise using visual pattern identification is an exciting finding which undoubtedly requires further investigation. However, the cognitive processes observed within each category are congruent with the established literature, (Dreyfus and Dreyfus, 2009, Elstein and Schwartz, 2000) on the development of expertise. No outcome measure is currently available which would encapsulate the impact of different levels of expertise upon the provision of EAT for the patient. This is a key area for future research.

The patterns observed in this study for Capable and Skilled levels of expertise participants concur with the Rivett and Higgs (1995) whereby novices tended to ask more questions regardless of relevance to the case. The forward reasoning described by Chi (2006) was apparent within the study data for the Accomplished participants whereby there was less information gathering prior to prescribing. In summary, the DPGs provided insight regarding the cognitive processes of all participants.

The development of the DPGs makes an important contribution to the expertise literature and has potential application in future research, education and clinical practice. As this appears to be the first clinical decision making study which has investigated the sequential use of cognitive processes with respect to level of expertise, testing of the observed patterns is required in further research. It may be possible to explore pattern recognition utilising machine learning if the data set is large enough (Bishop, 2006) and these results, whilst important, would benefit from further investigation. Within pre- and post- registration training and ongoing continuing professional development DPGs could be used as a tool to enable students and clinicians to identify their patterns of reasoning and map their skill development within a programme of reflective practice and professional development. The value of reflection in practice is familiar within the therapeutic professions (Schon, 1991) and is well recognised within the educational curriculums for OT and SLT (Brumfitt and Gray, 2009, Rowan and Alsop, 2009, Loftus et al., 2013). Spalding (2000) reported that within OT the rate at which newly qualified practitioners became proficient was influenced by their reflective skills. Jensen et al. (2008) asserts that experts learn from experience by using reflective practice or metacognitive strategies.

The levels of expertise were derived from self-rated data. The reliability of self-report may be compromised, either because of the limits of the participant's conscious self-knowledge or the impact of situational factors (Barker et al., 2005). In order to address these potential problems, the self-rating data and the expertise levels derived from the patterns in the DPGs were examined for association. It was found that approximately half of the BEs (*n*=9, 45%) and SLTs (*n*=10, 50%) had overestimated their level of expertise, just over a quarter (*n*=6, 30%) of all professions underestimated it and over half of the OTs (*n*=12, 60%) self-rating corresponded with their pattern of expertise. Such overestimation may not always be causally related to overconfidence in decision making. The psychological literature reports the impact of cognitive biases within decision making (Kahneman et al., 1982, Kahneman, 2011, Chi, 2006) and recommends that clinicians become familiar with and reflexive within their own practice in order to ensure effective decision making. Overconfidence is, paradoxically, often associated with incompetent individuals overestimating their ability (Croskerry and Norman, 2008), which can have detrimental implications for clinical practice. Within this study, the relationship between working in a team within an ATC may have contributed to overestimation in order that the participant may present themselves positively, a characteristic also associated with overconfidence (Croskerry and Norman, 2008). Self-awareness of levels of competence and expertise may have important implications for patient outcomes and this is an area for future research as it was not addressed in this particular study. Within the present study the final prescription was similar across all participants, with specific differences which reflected their specialist knowledge by profession as evidenced in Study 1. However, as this study did not examine the quality of the prescription, further research is required to investigate whether different levels of expertise impact upon the quality of the prescription and the impact which this may have on patient outcomes.

It is of note that when the patterns of the cognitive processes were allowed to speak for themselves through the visual pattern identification for expertise categorisation, a higher percentage of cases were correctly classified into three levels of expertise: Capable, Skilled and Accomplished than when the self-rated levels were used. This visual pattern identification was an exploratory approach that could be investigated further in the future but that would have the advantage of not relying on self-reported data but on evidence-based theories.

8.5 Discussion of Research Design and Process

8.5.1 The Use of Mixed Methods Design

This mixed methods study successfully integrated the findings from qualitative and quantitative data analysis in order to comprehensively explore the research aims. In common with other exploratory studies which seek to investigate little-researched areas, greater priority was given to the qualitative aspects of the study.

Onwuegbuzie and Leech (2005) propose that the goal of mixing methodologies is not corroboration of findings but expansion of knowledge, which is evidenced within this study by, for example, the development of the Decision Process Graphs. As noted in Chapter 3, Section 3.2 a key feature of mixed methods is integration, either of method or data analysis (Creswell, 2009). Integration was achieved within both studies using a combination of phases from the seven stages of mixed methods data analysis as proposed by Onwuegbuzie and Teddlie (2003) and outlined in Chapter 2. *Data reduction* was undertaken via thematic content analysis and analytical coding for the qualitative data and via descriptive analysis, regression, discriminant analysis and cross-tabulation for the quantitative data. *Data display* was evident in the use of tables, charts and diagrams throughout both studies. *Data transformation* and *integration* occurred via secondary analysis of the qualitative data whereby the frequency counts and sequence of occurrence of thematic and analytical codes were quantisised. Such transformation allowed greater exploration of the data and facilitated the emergence of patterns in relation to the use of the hypothetico-deductive approach, the development of Decision Process Graphs and the comparison of the use of decision making strategies between the professions.

Tashakkori (2009) reports that the quality of a mixed methods study depends upon the degree to which it meets the purpose for which it was employed. The conceptual framework developed by Greene (1989) is used below to assess the quality of the methodology and the findings in relation to the use of a mixed methods design.

Triangulation, the use of more than one method or source of data in order to seek convergence, corroboration or correspondence of results (Creswell, 2009, Greene, 1989) was undertaken in this study. The participants' reports of their specialist knowledge and role, derived from interview data in Study 1, were corroborated with the content of their decision making, as investigated by utilising the think-aloud method (Study 2). Study 1 also provided the context for the interpretation of findings from Study 2. Methodological triangulation was achieved thereby strengthening the internal validity of the results. Triangulation was also achieved with the work of the three naïve assessors who recoded 30% of the verbal protocols for content and process coding frameworks.

Complementarity is considered to be a strength of mixed methods research (Johnson and Onwuegbuzie, 2004) and seeks elaboration, enhancement, illustration and clarification of the results from one method with the results from the other method. Within this study, the use of the sequence of categorical data enabled the generation of the DPGs, which in turn provided insight into the data that would otherwise not have been possible.

Initiation seeks the discovery of paradox and fresh perspectives. Within this study, two key findings in particular contribute fresh perspectives to the clinical decision making literature; they are:

i. An enhanced hypothetico-deductive model of decision making was developed which is potentially suitable for the study of multi-disciplinary decision making within the field of complex disability;
ii. The Decision Process Graphs enable observation of patterns of decision making which can be associated with different levels of expertise.

Expansion seeks to extend the breadth and range of enquiry by using different methods to explore different aspects of the research question. This was achieved by:

i. The investigation into the content of decision making was extended by employing interview methodology to explore the participants' specialist knowledge and role within assessment of EAT.

Development consists of using the methods sequentially. This was not done in this study as the data collection took place in a single session.

8.5.2 **Representativeness of Population Sample**

The population accessed for this study was representative of the three professions. The gender ratio was 90% and 95% female for OT and SLT respectively which corresponds to the national figures of 93% and 97% per profession. The Health and Care Professions Council (HCPC) report that these figures have remained constant since 2007. A report by Engineering UK (Kiwana et al., 2011) reports that the UK has the lowest percentage of women in engineering in Europe at 8.7% which would equate to 1 female engineer within this sample population. Given that sample saturation was reached for BE participants, it is reasonable to conclude that the gender profile is representative of BEs within England.

8.5.3 Methods Employed

The way in which the use of semi-structured interviews and verbal protocol analysis successfully addressed the research question is discussed here. The interview method allowed the researcher to probe the key areas identified through the literature whilst still seeking clarification of responses in order to comprehensively investigate the perceptions of the participants of their roles and scope of specialist knowledge. This enabled each participant to provide a detailed and unlimited response in contrast to the use of a structured questionnaire, which generally employ categorical or ordinal predetermined responses. Interviews also provided the opportunity for unexpected responses, which were then explored further and had the potential to add new insights to the findings. By employing probe questions and a semi-structured approach the study was however also able to ensure that all participants engaged with the key areas reported in the literature. A limiting factor associated with the use of semi-structured interviews in this case is the possibility that the data may not represent all aspects of the participants' specialist knowledge and skills and only that which they easily recalled or were willing to share. To address this issue the study ensured that there were no time constraints set for the interview, participants were assured that there were no right and wrong answers, that all material was important and that they would not be individually identified in any reports. Interviews took place in settings known to the participants and participants appeared relaxed and willing to engage with the researcher.

An alternative approach considered, which might have addressed some of these issues, was to include a structured questionnaire alongside the semi-structured interview in order to study different aspects of role and knowledge. This could have been carried out as either questionnaire, interview or interview and questionnaire (Bryman, 2004) . In relation to this study, completion of a questionnaire after the interview would have enabled the researcher to ask follow-up questions and acquire further detail on specific issues. However, the inclusion of a questionnaire would have increased the length of data collection, which was already long, thereby affecting the validity of the findings. It was therefore rejected for this study.

It was observed that eight (13%) female participants (OT,*n*=5; SLT,*n*=3), none of whom were previously known to the researcher, presented with initial difficultly in reporting their specialist knowledge. Instead they commenced by listing the areas of knowledge relevant to assessment for EAT which they believed that a member of their profession should know. They reported feeling uncomfortable listing their own specialist knowledge as they did not want to be perceived as conceited or arrogant. Subsequent to clarification, all participants were able to report their specialist knowledge without further difficulty. Similar reluctance to rate themselves as "expert" was also observed with six (10%) female participants (BE, *n*=1; OT, *n*=3;SLT,*n*=2) when responding through the Dreyfus Skills Acquisition scale. Similar reasons were provided. In each case, considerable time was spent by participants in checking their skills against the Dreyfus descriptors before making a selection.

Such findings could arise for a number of reasons including the influence of personality, gender and the use of the Dreyfus scale for self-report. A study by Austin et al., (1998) regarding the influence of personality and self-report indicated that personality differences may affect the participant's responses and are particularly dependent upon their strength of feeling regarding the topic. Given the reluctance observed in these participants it may be that specialist knowledge has been under-reported by them. In the discriminant analysis associated with the DPGs it was found that there were participants who under-estimated their expertise though these have not been cross-referenced to these participants.

Pallier (2003) investigated the impact of gender on self–perceived accuracy when undertaking cognitive tasks and concluded that men consistently reported higher confidence in their accuracy ratings than women. Whilst these are interesting findings, caution must be applied when applying to this study as the majority of the participants (*n*=39, 65%) were female. Further research is required to explore if the impact of gender extends to self-perception of knowledge and expertise.

This study employed the Dreyfus Model of Skills Acquisition to examine the participants' perception of their expertise in the assessment for EAT. There is, however, limited research in self-perception of expertise as evaluated using the Dreyfus model and in the acceptability and reliability of the scale. A study which investigated nurses' self-report of their competence using a scale based on the Dreyfus model revealed good correspondence between their reported competence and clinical practice, by indicating that their perceived level of competence as competent-proficient was related to their years of experience (Garland, 1996). Within this study, the descriptors provided for each level of expertise were detailed and participants were able to seek clarification thereby potentially assisting with the accuracy of self-report. However, further investigation into the use of self-rating and self-report within this participant population and with their clinical expertise is required. Subsequent research should also take into consideration the possibility of self-report of the level of expertise which is not delivered face-to-face.

The use of verbal protocol analysis enabled investigation of the participants' contemporaneous thinking in a simulated case using materials which closely corresponded to their clinical experience. It generated comprehensive data which enabled detailed investigation into the content and cognitive processes undertaken by each participant during decision making, data that would not have been available from observations, surveys or focus groups. Participants appeared to become oblivious to the recording of the session as evidenced by their lack of reference to it whilst thinking aloud or being interviewed, which concurs with the findings of Aitken et al, (2011) and Forsberg et al. (2013) during their think-aloud data collection. Although participants were reminded that they could make notes, only eight (13%) out of the 61 participants did so and of these, five (8%) stopped after the first case scenario.

As noted in section 2.6.1, a limitation of this method is that, within clinical decision making research, the thinking-aloud process is generally undertaken as an individual activity as opposed to a group task. Group tasks may be more representative of multi-disciplinary decision making in clinical practice. In such instances, combining individual thinking-aloud tasks followed by focus group discussion may be a useful design for future research in order to investigate potential differences between a prescription for EAT resulting from individual and group decision making. No reports of this combination of methods within the CDM literature were found.

Although concurrent thinking aloud is frequently used to investigate decision making and reasoning (Skaner et al., 2005, Offredy, 2002, Twycross and Powls, 2006, Prime and Le Masurier, 2000) there is a paucity of literature regarding the procedural issues which need to be considered when undertaking this method; van Someren (1994) additionally noted the lack of detailed procedural guidelines. Ericsson and Simon (1993) recommended the observance of a number of items during data collection, which were vigilantly adhered to in the current study. In this method, lack of attentive observation during data collection may result in an inappropriate level of verbalisation and the thinking aloud might become explanation or commentary (Hoppmann, 2009). Procedural specifics were unusually reported within one recent paper by Lundgren-Laine and Salantera (2010) who, in common with researchers such as Carter (2007), Cotton and Gresty (2006) and van Sommeren (1994), mentioned above, also commented on the insufficiency of reported detailed methods and procedures. The procedures undertaken by Lundgren-Laine and Salantera (2010) were consistent with those in this study and included: 1) adapting the practice tasks to clinically appropriate ones, 2) the use of written and oral instructions, 3) using a quiet room and 4) reminders to keep thinking aloud. There were two significant differences however. Lundgren-Laine and Salantera (2010) did not use any of the Ericsson and Simon (1993) arithmetic tasks and they permitted normal communication related to the working situation, including the open question “what are you thinking / doing?”. During the pilot phase of this study the use of such a question generated an adverse change in the level of verbalisation and was therefore excluded from the procedure. During a debriefing conversation with each participant after data collection, a number of procedural issues were also noted which are important methodological concerns, discussed below, and should be taken into consideration in future research. With the review that followed every data collection session it also became evident that all issues raised had been addressed and did not impact upon the validity of the findings. The key issues were:

i. Similar to Thinking Through a Clinical Referral

The majority of participants engaged in thinking aloud without difficulty subsequent to completion of the practice items. They reported that the procedure was similar to thinking through a new clinical referral. These comments indicate that ecological validity was achieved, which provides assurance that the findings are likely to represent their typical reasoning and decision-making in clinical practice.

ii. Feeling Assessed

Prior to data collection, four (6%) participants commented that they were nervous about thinking aloud, likening it to an assessment of their abilities. Forsberg et al. (2013) also reported similar findings with "some nurses" in their study of clinical reasoning in nursing. Within the current study, the participants were reassured that there was no element of assessment and no right or wrong answer. All were content to continue with the data collection.

iii. Fear of Revealing Perceived Incompetence

Two (3%) of the above participants were also concerned that they may reveal some aspect of professional incompetence or compromise their reputation. After reassurance that all the data would remain confidential and that there was no right or wrong answer, the participants continued with the data collection. No research appears to have been reported regarding this aspect of thinking-aloud.

iv. Disorganised Thinking

Seven (11%) participants reported that they felt that their thinking was disorganised and not logical, which was surprising to them. Lemke (2011) reported that normal spoken language is full of hesitations, repetitions, false starts and grammatical errors which will be observed in think-aloud protocols. Ericsson and Simon (1980b) reported that the verbal protocols from their studies also indicated disorganised verbal expression, which is representative of the thinking process. Simmons et al. (2003) found that their nurse participants were not consciously aware of the cognitive processes they were using or how they organized information.

v. Cognitive Fatigue

Three (5%) of participants specifically mentioned that thinking-aloud was tiring and they felt cognitively fatigued at the end of the data collection. Within the clinical decision making literature, the length of time taken ranged from 3-20 minutes per case scenario (Offredy, 2002), 10-15 minutes per protocol (Cioffi and Markham, 1997, Jones, 1989) and 30 minutes to 2 hours (Grobe et al., 1991, Embrey et al., 1996, Simmons et al., 2003). The cognitive fatigue was not apparent in this study's verbal protocols but has implications for future research whereby extended data collection may affect the validity of the findings. Investigation regarding an optimum time period for thinking-aloud data collection would be beneficial.

These procedural issues reported during the debriefing interview make an important contribution to the methodological literature and assist with the refinement of the think-aloud method. They also have implications for use of the think-aloud method within clinical practice and education as recommended in Section 8.3.

8.5.4 **Materials Employed**

8.5.4.1 **Decision-Making Process Codes**

The modified process-based codes developed in the field of nursing in order to examine cognitive decision making processes in the field of EAT were successfully applied within this study. As reported in Chapter 3 the codes were extended in order to ensure that no data was left un-coded within the verbal protocols and in order to apply them within the field of assistive technology. Incorporating the code 'discard' within the decision making codes is potentially misleading as it may suggest that it applies to the participant's discarding information during the decision making task as opposed to the researcher discarding information which did not result from thinking aloud such as explanation or commentary when analysing the verbal protocols. It is an essential component when analysing thinking-aloud verbal protocols but should be kept separate as a methodological process. Although the codes predict and review were used infrequently and were excluded from statistical analysis they could be explored further in future research. The heuristic anchoring and adjustment which best corresponds to the predict code was used the least by the participants.

8.5.4.2 **Enhanced Case Scenarios**

Based on the debriefing information from the participants, the use of enhanced case scenarios was successful in replicating clinical practice and enabled the participants to display both the content and process of their decision making. There was no apparent difference between the professions in relation to their engagement with the enhanced case scenarios. Over 75% of the participants reported at the end of data collection how similar the cases were to those with whom they worked and were convinced by the user as a real case. However, four BEs and one SLT (n=5; 8% of sample) commented upon their perception of how case scenarios decontextualized the service user as, for example, the BEs habitually took into consideration the service user's demeanour and approach to life during assessment. However, they reported that the inclusion of the video footage and ability to ask questions enabled them to gain enough satisfactory information in order to prescribe. Given that such views were reported by less than 10% of the participants it may be that it reflects their personal preferences and potentially their level of expertise. However further research into factors that influence the decision making of EAT professionals is necessary.

Three behaviours of engagement with the case scenarios were observed from the participants during the data collection session, regardless of profession.

i. An engaged approach in which the participant related to the written and visual information as though they were talking directly to the service user. They often asked at the end of the data collection what had, in reality, been prescribed and how the service user was getting on with their AT devices. They had forgotten that the case scenarios were simulations and not real clinical cases. This was, additionally, taken as further confirmation of the face validity of the use of the case scenarios.

ii. Participants displayed a detached and task-orientated approach to the data and used the information to generate a solution in a purposeful manner without any evidence of emotional involvement. This behaviour was seen across genders and professions.

iii. While reading the physical status of both case scenarios, approximately one third of the participants simulated the physical movement in order to assist with interpretation of the physical status. This was more common among BEs and OTs than SLTs, which may reflect their professional training, their area of expertise (SLTs are likely to be less familiar and knowledgeable of physical matters) or preferred learning style: kinaesthetic rather than visual or auditory (Fleming and Mills, 1992).

1) **Format and Content of Written Case Scenarios**

The written case scenarios were successfully employed within this study and the comments reported during the debriefing conversation appear to reflect individual preferences. The format of the written case scenario did not present difficulty to any participant, although three OTs from ATCs commented that as they were so familiar with their own team's format it took a little longer to process. The presentation of the content was acceptable to the majority of participants; one ATC SLT reported they would have preferred the information to be presented as the service user's functional abilities rather than factual medical details. In contrast, a BIU OT would have preferred more specificity regarding the affected structures and neurological damage. In relation to clinical complexity of the case, five OTs (4 BIU, 1 ATC) and three SLTs (BIU) (n=8; 13% of sample) commented that they found case A more complex than case B. The cases were carefully constructed to be clinically equivalent with enough elements for all professions to concentrate upon. The case which was considered the most complex by the above participants may reflect their clinical experience with service users presenting with minimal physical ability, which was the aspect they found most challenging. The presentation of the case scenarios was randomised in order to help reduce any effect due to their inherent differences. Statistical analysis (section 3.7) showed there was no difference in the way they were solved based on the frequency of the use of the cognitive decision making process codes.

2) **Engagement with the Video Footage**

The inclusion of video footage was considered essential by all professions and the SLTs reported how it assisted them with their interpretation of the physical symptoms. A number of participants appeared to "talk" to the user whist watching the footage and subsequently spent the remaining time during the viewing of the footage thinking aloud. The majority of the BEs (n=17, 85%) scrutinised the footage in considerable detail, taking into consideration aspects such as facial expression, speed of eye blink and grimacing. The OTs used the footage to confirm their interpretation of the written information and did not scrutinise it in as much detail as the BEs. There was variability across the SLTs: those who worked closely with OTs and BEs (*n*=10, 50%) interacted with it in a similar way to OTs whereas all other SLTs felt it was necessary to see it before they could fully interpret the written information. The inclusion of simulated video-footage as a component of a case scenario contributed to face and ecological validity. Videotaped patient segments have only been previously reported within two nursing decision making studies (Tanner et al., 1987, Lamond et al., 1996b) and neither study reported on the participants' engagement with the video-footage. The inclusion of simulated video-footage in future studies should contribute towards methodological vigilance by ensuring that the simulation be accurate and fully representative. It should be considered, as it was within this study, an essential component in the case scenario and not simply an adjunct to the written material.

3) **Engagement with the Speech Sample**

The speech sample was important in enabling 45% (*n*=9) of OTs and 80% (*n*=16) of BEs to translate the written description of the communication disorder into something meaningful. After hearing the recorded speech most of the participants stated that it confirmed their opinion that a communication aid was required. It was found that within the context of decision making for prescription of an EAT device, the service user's functional use of speech was more relevant than the articulatory characteristics of the impairment. This approach concurs with the social model of disability.

8.6 Limitations

A potential for bias arose during data collection and was addressed with a standardised approach. Eight (13%) of the participants (BE,*n*=2;OT,*n*=2;SLT,*n*=4) were known to the researcher in a professional capacity prior to becoming research participants. Given the specialist nature of the AT job and the relatively small number of professionals involved in the field within England, it was unavoidable to already know some of the participants. In order to counteract this potential bias the researcher took precautions to remain formal and to follow standardised procedural guidelines. Again participants were assured there were no right or wrong answers and that they would not be named in reports. The researcher was consistently vigilant in maintaining her role as the investigator throughout the data collection. Additionally the relevant verbal protocols were examined to ascertain if there was any evidence of impact on the data, for example, if the participants particularly focused on the communication component of the prescription, but there were none.

The involvement of service users is an important aspect of CDM and although there was no expectation that it would form part of this study it may be perceived to be a limitation.

From a service design viewpoint it would have been helpful to have collected data regarding the participants' level of employment within their organisation, for example, their salary banding within the NHS. However, the banding of staff was not collected for this study as a) it was not a key component of the question to be answered and b) participants were sourced from the NHS, charitable organisations, and the private sector so direct comparisons across organisations would not have been possible. Further research is required in order to investigate whether the banding of an employee impacts their performance and consequently patient outcomes.

8.7 Implications for Service Design, Manpower Planning and Clinical Practice

This current study has generated important findings which has implications for the EAT service design and manpower planning and has the potential to impact clinical practice and pre-registration education. The fact that all three professions were required to address all the issues raised during the clinical decision-making assessment tasks and no single profession was able to address all the issues has implications for service design and manpower planning. While it is recognised that not all service users will present with issues limited to those raised within this task, the content and ecological validity of the enhanced case scenarios indicate that they are reflective of the participants' service users.

The findings cannot be directly applied to clinical practice however and an intermediate stage is required in order to enable confirmation of the findings and contribute towards good practice clinical guidance. Clinical guidelines provide information on minimum best practice to assist in the clinical decision-making process and contain recommendations that provide specific clinical guidance on the assessment process, intervention and management of specific disorders and populations. It is anticipated that the findings from this study could contribute towards such guidance. This guidance could be achieved by:

i. Running a number of multi-disciplinary focus groups around England composed of EAT professionals to discuss the findings. Such groups could be potentially formed from the study participants and other interested professionals. The benefits of focus group research include the ability to gain different perspectives about the findings from a range of professionals in an organised discursive forum and can assist with validating the findings and applying them to clinical practice. From the present findings the key items for discussion would be:
    a. The high degree of similarity between the professions in relation to the content and process of their decision making;
    b. The relevance, application and appropriateness of the Person and Equipment themes;
    c. The profession–specific differences in their role;
    d. the clinical utility of using the think-aloud method to inform and increase awareness of an individual's clinical reasoning;

ii. An outcome of the focus group could be the development of good practice guidance drawing on the Person and Equipment framework results in Chapter 7, Section 7.2 and the results of the Specialist Knowledge and Role study in Chapter 5, Section 5.4 .

iii. Liaising with the Computer Science Research Institute at the University of Ulster to explore the possibility of undertaking machine learning on the process strategy codes as used to generate the DPGs. This would test the accuracy of the observations employed and the criteria thus derived in the categorisation of the different levels of expertise in the DPGs. This possibility is discussed further in the recommendations section in 8.9.1;

iv. Undertaking a study to investigate the use of the thinking-aloud methodology in clinical decision making and clinical reasoning tasks relevant to ongoing professional development within clinical practice and pre-registration training in the healthcare professions. Materials relevant to a wide range of clinical disorders would need to be developed and tested in addition to a time-effective method of analysing the think aloud protocols. The findings could be employed to develop an approach to assist with continuing professional development within clinical practice and pre-registration training to enable the clinician or student clinician to become aware of the cognitive processes employed during clinical reasoning exercises. This might provide a quicker way of achieving competent and confident decision making.

8.8 Recommendations for Future Research

This study has investigated the content and process of decision making by three professions during the assessment for EAT. Additionally it has explored their self-perceptions regarding their areas of specialist knowledge and their role in the assessment. The recommendations for future research seek to extend elements of the current study in addition to expanding our understanding of decision making within EAT to encompass the factors which influence single profession decision making and multidisciplinary team decision making within the NHS workforce. It is anticipated that the findings of such research will influence and inform EAT service design and manpower planning.

8.8.1 Recommendations for future research

i. Investigation into the application of the enhanced hypothetico-deductive model in complex disability.

    This is the first reported study which has shown the use of an enhanced hypothetico-deductive model during decision-making within healthcare. Additionally it was employed by all three professions during the same decision making task. As reported in Chapter 2, Section 2.5, little is known about the clinical decision making within biomedical engineering and speech and language therapy and the only study sourced which investigated CDM in BE (Ramirez, 1995) found that their decision making flow chart was likely to have been derived from the principles of normative theory. The present study shows that the descriptive approach to decision making was employed whereby the decisions were made within a real world context and no limitations were placed upon the exclusive use of rationality or logic.

    It is evident from the literature that CDM in some nursing, midwifery and psychiatry studies extends beyond the hypothetico-deductive model. As reported in Section 8.2, the closest correspondence reported in the literature to the decision making in EAT was within psychiatry (Bhugra et al., 2011) as they both shared the same underpinning theoretical model of health. As the hypothetico-deductive model was generated when the medical model of disability was dominant, it is important to investigate if an enhanced model is more widespread given the predominant use of the social model of disability and the impact the use of the enhanced model may have on clinical outcomes for the patient.

In order to test the utility of the enhanced hypothetico-deductive model it is important to test it within different clinical populations with complex disorders such as multiple sclerosis and cerebral palsy. A multidisciplinary team approach is also commonplace within such disorders, which would enable investigation of a range of different professions.

In order to access the participant's cognitive decision making it is recommended that TA would be the most suitable design. Such a design would also enable the data to be examined for its use of the dual-process of decision making. TA in turn, would be a valuable tool for informing the clinical education of the professionals as part of their continuing professional development.

ii. Exploration of the patterns derived from the Decision Process Graphs by using a machine learning approach.

The innovative use of the DPGs resulted in patterns of decision making which reflected different levels of expertise consistent with the literature (Elstein and Schwartz, 2000). This finding requires further investigation in order to confirm the accuracy of the criteria which was employed in the categorisation of the different levels of expertise as there is real potential to apply the findings to professional development within the clinical setting as well as within pre-registration training of student clinicians. It is anticipated that machine learning will be undertaken in collaboration with the

Computer Science Research Institute at the University of Ulster. If clinicians and students are able to generate a pattern (using a modification of the TA approach, appropriate for clinical practice) which provides information regarding their cognitive processes as utilised within a decision making task, it has the potential to inform and increase awareness of an individual's clinical reasoning and enhance their critical thinking and reflective practice. There is also the possibility that this awareness may help reduce cognitive errors and biases, which in turn is likely to positively impact upon patient outcomes.

iii. Are there differences in the effectiveness of EAT provision dependent upon interdisciplinary, transdisciplinary or multi-disciplinary team decision making?

The ability to prescribe EAT, which optimally meets the needs of the service user and where the likelihood of abandonment is reduced is a significant challenge for all AT services. With an increasing financially-stretched NHS where the pool of equipment from which to select may be limited, prescribing the best-fit technology is crucial.

Findings from Study 1 reported on the importance of joint working and making team-based decisions (Chapter 5, Section 5.6). As this research has shown EAT prescriptions are made by professionals working in a variety of settings throughout England and little is known about the outcome for the user of such variation in service settings. While the findings of the present study showed similar prescriptions across professions and work settings, it did not seek to examine the effectiveness of the recommendation. Team working has been recommended as a model of practice (Beukleman and Mirenda, 2005) and benefits include increased knowledge, skills, and confidence of team members ((Copley and Ziviani, 2007).

Effectiveness of the outcome could be investigated using published AT outcome measures such as the PIADS (Jutai and Day, 2002b) and QUEST (Demers et al., 2002) alongside profession-specific or disease-specific measures. Such information would be of value nationally in order to design services which provide the optimal outcome for the service user.

8.9 Conclusions

This research set out to explore if there were similarities and differences in the clinical decision making of BEs, OTs and SLTs during the assessment process for EAT. The findings indicate that:

i. there is a high degree of similarity between the professions although profession-specific differences were reported in relation to specialist knowledge and role;
ii. An enhanced version of the hypothetico-deductive model was employed by the participants, which extends beyond that employed in diagnostic decision making and into the implementation of the solution;
iii. The participants demonstrated use of the dual-process theory of decision making;
iv. Patterns were observed in the use of decision-making process strategies, which may indicate differences in the CDM process dependent upon level of expertise;
v. The findings have the potential to influence EAT service design, manpower planning and clinical practice in the assessment for EAT and contribute to the development of good practice clinical guidance.

Little was known about the CDM of these professions in this field and this study is valuable in furthering knowledge which can be applied within the clinical and educational settings.

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Appendix 1

Enhanced Case Scenario Footage and Audio Sample on DVD

Appendix 2

The Jefferson Lite Transcription System as used in this Research

The transcription system uses standard punctuation marks (comma, stop, question mark); however, in the system they mark intonation rather than syntax. Arrows are used for more extreme intonational contours and should be used sparingly. The system marks noticeable emphasis, volume shifts, and so on. A generally loud speaker should not be rendered in capitals throughout.

[ ]	Square brackets mark the start and end of overlapping speech.
_	Vertical arrows precede marked pitch movement, over and above normal rhythms of speech. They are used for notable changes in pitch beyond those represented by stops, commas and question marks.
Underlining	indicates emphasis; the extent of underlining within individual words locates emphasis and also indicates how heavy it is.
CAPITALS	mark speech that is hearably louder than surrounding speech. This is beyond the increase in volume that comes as a by product of emphasis.
(0.4)	Numbers in round brackets measure pauses in seconds (in this case, 4 tenths of a second). If they are not part of a particular speaker's talk they should be on a new line. If in doubt use a new line.
(.)	A micropause, hearable but too short to measure.
she wa::nted	Colons show degrees of elongation of the prior sound; the more colons, the more elongation.
Yeh,	'Continuation' marker, speaker has not finished; marked by fall-rise or weak rising intonation, as when delivering a list.
heh heh	Voiced laughter. Can have other symbols added, such as underlinings, pitch movement, extra aspiration, etc.

Appendix 3

Participant Information Sheet

School of Biomedical & Health Sciences
Division of Applied Biomedical Research

Sylvia Taylor-Goh
MSc, BSc, Reg MRCSLT
Doctoral Student

Room 3:11 Shepherd's House
Guy's Campus
London SE1 1UL
Telephone: +44 0)20 7848 6679
Mobile: 07960 069289
Email: sylvia.taylor-goh@kcl.ac.uk

KING'S College LONDON
University of London

INFORMATION SHEET FOR PARTICIPANTS

Title of study

An examination of the factors which contribute to clinical decision making by occupational therapists, rehabilitation engineers and speech and language therapists during assessment for electronic assistive technology

Why have I been invited?

We would like to invite you to take part in this PhD research study. The reason that you have been invited is because you work with adults with acquired brain injury and require assistive technology. We don't know a lot about clinical decision making in assistive technology and it would be great if you could help.

Before you decide whether you want to take part it is important for you to understand why the research is being done and how you would be involved. Please take time to read the following information carefully and discuss it with others if you wish. Ask us if there is anything that is not clear or if you would like more information. You are under no obligation to take part and may decline without giving a reason. If you decide to take part you will be given this information sheet to keep and be asked to sign a consent form. You are free to withdraw at any time.

The purpose of the study

Currently, when an individual needs assistive technology, they are likely to undergo a multi-disciplinary assessment by a number of professionals. Subsequent to this, a recommendation will be made regarding what type of device(s) may be suitable. Although we suspect that such professionals may consider similar core data we do not know if or how this information is used to help them arrive at a decision. At present, we don't know what informs their clinical reasoning and subsequent decision making. We do know that wrongful prescription of assistive technology is not only very costly but can be detrimental to the individual's health, quality of life and independence.

The purpose of this study, therefore, is to find out how a number of different professionals make decisions when they assess individuals who have an acquired brain injury and who need electronic assistive technology. Using video enhanced case scenarios, each research participant will be asked to “think aloud” as they arrive at a decision regarding what to prescribe. The “think-aloud” procedure will simply ask you to verbalize what you are thinking to help us access your clinical reasoning and decision making process. This is useful to inform our understanding of how different members of the team decide what to prescribe.

What will I have to do?

If you decide to take part, I will come and visit you at work. We will meet once only in a quiet, private room for up to an hour and a half. During this time you will:

- Read and sign the Consent Form;
- Practice the “think-aloud” procedure;
- Read and view three video-enhanced case scenarios of adults with an acquired brain injury and who require some form of electronic assistive technology;
- Think out loud as you assess and decide what to recommend;
- Have the opportunity to add any further information in a brief conversation at the end.

The session will be audio recorded to allow for later analysis and you will be to request a copy of the full transcript when available. The session will be transcribed verbatim, after which the audio recording will be deleted.

Will my information be kept confidential?

All information collected during the course of the research will be kept strictly confidential. Any information about you which has your name and address will be removed so that you cannot be recognized. Only I, the chief investigator in this study will have access to this information. However, in the unlikely event that you make a disclosure of practice which could cause harm to a patient, I am bound to inform your direct line manager of this event. Your right to confidentially would therefore be waived.

All research in the NHS is looked at by an independent body, called a Research Ethics Committee to protect your safety, rights, wellbeing and dignity. This study has been reviewed and given favourable opinion by Hertfordshire Research Ethics Committee.

What if there is a problem?

Should you wish to make a make a formal complaint regarding any aspect of your involvement, you can do so by contacting the Director of Applied Biomedical Research, Professor Di Newham at Division of Applied Biomedical Research, 3:1 Shepherds House, King's College London, Guy's Campus, London SE1 1UL.

In the event of your suffering any adverse effects shown to be a consequence of your participation in this study, you may be compensated through the King's College London "No Fault" Compensation Scheme.

What should I do now?

If you are willing to take part, can you please complete the response slip and return it to me in the enclosed stamped addressed envelope as soon as possible. I will then contact you to talk about the study in more detail and set up a time for us to meet.

If I don't hear from you within the next 3 weeks I will drop you a reminder. Don't worry – you will only receive one reminder!

Further information and Contact Details

This study is in fulfillment of a PhD under the supervision of Dr Ruth Mayagoitia-Hill, Co-ordinator, MSc in Assistive Technology, Centre of Rehabilitation Engineering (CoRE), King's College London and Professor Sheila Kitchen, Head of Academic Department of Physiotherapy, King's College London.

If you need any further information please contact Sylvia Taylor-Goh, the chief investigator at

sylvia.taylor-goh@kcl.ac.uk or on 020 7848 6679.

18 January 2008

Version 6

“An examination of the factors which contribute to clinical decision making by occupational therapists, rehabilitation engineers and speech and language therapists during assessment for electronic assistive technology”

RESPONSE SLIP

Please complete and return in the enclosed stamped addressed envelope.

I am happy to be contacted to talk about the study in more detail.

Name:

Job Title:

Work Address:

Email:

Phone:

Preferred method of contact – please tick

Email □

Phone □

Thanks very much,

Sylvia Taylor-Goh

Appendix 4

Explanation and Practice Tasks

Purpose of study

- Multi-disciplinary assessment leading to recommendation
- We suspect that such professionals may consider similar core data but we do not know if or how this information is used to help them arrive at a decision
- We don't know what informs their clinical reasoning and subsequent decision making
- Wrongful prescription of assistive technology is not only very costly but can be detrimental to the individual's health, quality of life and independence.
- Purpose is to find out how a number of different professionals make decisions when they assess individuals who have an acquired brain injury and who need electronic assistive technology

"Thinking aloud"

- The "think-aloud" procedure simply asks you to verbalize what you are thinking as you would in everyday life
- When thinking aloud I don't want you to try and plan out what you say or try to explain to me what you are saying. Simply think aloud.
- Don't give a commentary on how you're thinking
- No right or wrong answer or method

What's next?

- Opportunity to practice thinking aloud
    - Several different problem solving exercises followed by a practice case scenario
- Then 2 actual case scenarios, each accompanied by footage of physical status and a speech sample

Appendix 4 continued

Practice tasks

1. Can you multiply 24 x 36 and instead of thinking about it in your head say it out loud.

2. How many windows are in your (parent's) house? Keep thinking aloud as you work this out.

3. Now for a practice case scenario.

I'm going to give you fairly typical written referral information in addition to a short video of his physical status and a speech sample. Your task is to work out what equipment you would prescribe for this man. I would like you to read, watch and listen to all the information available.

I want you to start thinking aloud as soon as you begin to read and continue as you watch and listen as well. If you stop thinking aloud for any length of time I will remind you to continue.

You can make notes if you wish. If you need further information you can ask me as I have his records. If you ask for any information I need you to make clear your reason for asking. I'll give you an answer if I can but I won't get involved in conversation.

The most important thing is to keep thinking aloud at all times.

So, imagine that you have been asked to assess this man. I want you to do what you would typically do in clinical practice.

Appendix 5

Letter of Invitation to Participate in the Study

KING'S College LONDON
University of London

School of Biomedical & Health Sciences
Division of Applied Biomedical Research

Sylvia Taylor-Goh
MSc, BSc, Reg MRCSLT
Doctoral Student

Room 3:11 Shepherd's House
Guy's Campus
London SE1 1UL
Telephone: +44 0)20 7848 6679
Mobile: 07960 069289
Email: sylvia.taylor-goh@kcl.ac.uk

15 February 2008

Dear Colleague

Re: An examination of the factors which contribute to clinical decision making by occupational therapists, rehabilitation engineers and speech and language therapists during assessment for electronic assistive technology.

I would like to invite you to take part in this PhD research study which is investigating how a number of different professions make decisions when they assess individuals who have an acquired brain injury and who need electronic assistive technology. Very little is known regarding what factors influence the making of decisions in this context and how these professionals arrive at their equipment recommendations. As you will know, there is a high rate of abandonment of assistive technology and it is important to ensure that the assessment and prescription meets the needs of the user.

I am aware that you are very busy and that time is precious – however, I would be very grateful if you would consider taking part in this study. You would be seen once at your place of work for up to 90 minutes in order to "think-aloud" while considering how you would assess two individuals (presented as video-enhanced written case scenarios) for electronic assistive technology. Immediately after the "think-aloud" session there will be a brief follow up conversation. I have enclosed an information sheet, which outlines the study in more detail and explains further how you would be involved.

This study is in fulfilment of a PhD under the supervision of Dr Ruth Mayagoitia-Hill, Co-ordinator, MSc in Assistive Technology, Centre of Rehabilitation Engineering (CoRE), King's College London and Professor Sheila Kitchen, Head of Academic Department of Physiotherapy, King's College London. This study has been reviewed and given a favourable opinion by Hertfordshire Research Ethics Committee.

I would be delighted if you were willing to take part. I have enclosed a response slip and stamped addressed envelope, which you can use to express your interest. Should you wish to get in contact I would be very pleased to hear from you. I can be contacted via sylvia.taylor-goh@kcl.ac.uk or on 020 7848 6679 / 07960 069289.

I look forward to hearing from you at your earliest convenience,

With best regards

Sylvia Taylor-Goh, BSc, MSc, MRCSLT

Appendix 6

NRES Letter of Approval

National Research Ethics Service

Hertfordshire REC
Location Code Q7
Via QEII Hospital Post Room
Howlands
Welwyn Garden City
Herts
AL7 4HQ

Telephone: 01707 362583
Facsimile: 01707 394475

23 January 2008

Mrs Sylvia Taylor-Goh
Doctoral Student
King's College London
School of Biomedical & Health Sciences,
PhD Office, Rm SH 3.11,
Shepherd's House
Guys Campus
London SE1 1UL

Dear Mrs Taylor-Goh

Full title of study:	**An examination of the factors which contribute to clinical decision making by Occupational Therapists, Rehabilitation Engineers and Speech and Language Therapists during assessment for electronic assistive technology.**
REC reference number:	**07/H0311/201**

Thank you for your letter of 18 January 2008, responding to the Committee's request for further information on the above research and submitting revised documentation.

The further information has been considered on behalf of the Committee by the Chair.

Confirmation of ethical opinion

On behalf of the Committee, I am pleased to confirm a favourable ethical opinion for the above research on the basis described in the application form, protocol and supporting documentation as revised.

Ethical review of research sites

The Committee has designated this study as exempt from site-specific assessment (SSA. There is no requirement for other Local Research Ethics Committees to be informed or for site-specific assessment to be carried out at each site.

Conditions of approval

The favourable opinion is given provided that you comply with the conditions set out in the attached document. You are advised to study the conditions carefully.

Appendix 6 continued

Approved documents

The final list of documents reviewed and approved by the Committee is as follows:

Document	*Version*	*Date*
Application		07 November 2007
Investigator CV		02 November 2007
Protocol	3	02 November 2007
Covering Letter		02 November 2007
Compensation Arrangements		08 August 2007
Letter of invitation to participant		02 November 2007
Participant Information Sheet	V6	18 January 2008
Participant Consent Form	3	02 November 2007
Response to Request for Further Information		18 January 2008
Response Slip	V1	
Advertisement	1	02 November 2007
Supervisor's CV		02 November 2007

R&D approval

All researchers and research collaborators who will be participating in the research at NHS sites should apply for R&D approval from the relevant care organisation, if they have not yet done so. R&D approval is required, whether or not the study is exempt from SSA. You should advise researchers and local collaborators accordingly.

Guidance on applying for R&D approval is available from http://www.rdforum.nhs.uk/rdform.htm.

Statement of compliance

The Committee is constituted in accordance with the Governance Arrangements for Research Ethics Committees (July 2001) and complies fully with the Standard Operating Procedures for Research Ethics Committees in the UK.

After ethical review

Now that you have completed the application process please visit the National Research Ethics Website > After Review

Here you will find links to the following

a) Providing feedback. You are invited to give your view of the service that you have received from the National Research Ethics Service on the application procedure. If you wish to make your views known please use the feedback form available on the website.
b) Progress Reports. Please refer to the attached Standard conditions of approval by Research Ethics Committees.
c) Safety Reports. Please refer to the attached Standard conditions of approval by Research Ethics Committees.
d) Amendments. Please refer to the attached Standard conditions of approval by Research Ethics Committees.
e) End of Study/Project. Please refer to the attached Standard conditions of approval by Research Ethics Committees.

We would also like to inform you that we consult regularly with stakeholders to improve our service. If you would like to join our Reference Group please email referencegroup@nationalres.org.uk .

07/H0311/201	Please quote this number on all correspondence

With the Committee's best wishes for the success of this project

Yours sincerely

pp

Dr Steve Eckersall
Chair

Email: jenny.austin@nhs.net

Enclosures: Standard approval conditions SL-AC2 for other studies

Copy to: Dr Ruth Mayagoitia-Hill
Academic Department of Physiotherapy
Rm4, 16 Shepherd's House
Guy's Campus
Kings College London
London SE1 1UL

Appendix 7

Example of R & D Approval

Research & Development Directorate
Room 2.05/2.06
Clinical Science Centre for Research & Education

NHS Trust

University Hospit

R&D Director- Professor
R&D Manager- Mr.
R&D Co-ordinator – Ms

Tel: Fax:
Email:

TO:	Sylvia Taylor-Goh – Kings College London
FROM:	Mr. - R&D Manager
DATE:	27th May 2008
Re:	**R&D Management Approval: Study Title:** Approaches to decision making in assessment for assistive technology **R&D Ref:** 08OC001 **Ethics Ref:** 07/H0311/201

I am writing to acknowledge receipt of the fully completed Registration Documents for the above project.

I am pleased to inform you that the R&D Committee has now granted management approval and the project has been entered into the Trust's R&D Project Database. Trust's indemnity is in place for staff working on the project.

For this project you have personally undertaken to ensure that all work carried out within the Trust will at all times comply with the Medicines for Human Use (Clinical Trials) Regulations 2004 and standards defined within the ICH-GCP guidelines.

Additionally, in accordance with the NHS Research Governance Framework, we simultaneously require copies of any reports you send in connection with this study, that concerns the details of any Trust patients involved in:-

a) **Serious Adverse Events (SAE's), as defined by the study Protocol**
b) **Suspected, Unexpected, Serious Adverse Reactions (SUSAR's)**

Please also note that Research Governance stipulates that we will require a copy of your project outcome report as soon as this becomes available.

Yours sincerely,

Cc - Rheumatology

082705Man Appr Letter – S Taylor-Goh

Appendix 8

Anonymised Consent Form

School of
Biomedical &
Health Sciences
Research

Division of
Applied
Biomedical
Research

Sylvia Taylor-Goh,
BSc MSc MRCSLT

PhD Office,
Rm 3.11
Shepherd's House
Guy's Campus
London SE1 1UL
Telephone: +44 0)20 7848 6679
Mobile: 07960 069289
Email: sylvia.taylor-goh@kcl.ac.uk

KING'S College LONDON
University of

Participant Consent Number: 2

CONSENT FORM

Title of Project

An examination of the factors which contribute to clinical decision making by Occupational Therapists, Rehabilitation Engineers and Speech and Language Therapists during assessment for electronic assistive technology.

Name of Researcher: Sylvia Taylor-Goh

Please initial box

1. I confirm that I have read and understand the information sheet dated 18 January 2008, Version 6 for the above study. I have had the opportunity to consider the information, ask questions and have had these answered satisfactorily. ✓
2. I understand that the session with be audio recorded and I agree to this procedure. ✓
3. I understand that my participation is voluntary and that I am free to withdraw at any time without giving any reason. ✓
4. I consent to the processing of my personal information for the purposes of this study. I understand that such information will be treated as strictly confidential and handled in accordance with the provisions of the Data Protection Act 1998. ✓
5. I agree to take part in the above study. ✓

Name of Participant	Monday 9th June '08 Date	Signature
Name of Person taking consent	9/6/08 Date	S TAYLOR GOH Signature

Version 4
20 January 2008

Appendix 9

Detailed participant characteristics

Participant	Setting	Profession	Years qualified	Experience with EAT	Experience with ABI	Expertise Self-Rating
1*	ATC	SLT	8	7	7	Competent
2	ATC	BE	12	5	5	Proficient
3	ATC	OT	13	12	13	Proficient
4	ATC	BE	22	9	9	Proficient
5	ATC	BE	22	10	12	Expert
6	ATC	OT	22	4	22	Proficient
7	ATC	SLT	8	5	6	Expert
8	ATC	SLT	30	10	5	Expert
9	ATC	SLT	3	2	3	Proficient
10	BIU	OT	17	17	17	Competent
11	ATC	OT	8	17	17	Expert
12	BIU	SLT	15	12	12	Advanced Beginner
13	ATC	SLT	18	12	18	Competent
14	ATC	OT	13	12	12	Expert
15	BIU	OT	2	2	2	Advanced Beginner
16	BIU	SLT	9	6	6	Competent
17	ATC	OT	33	13	13	Proficient
18	BIU	OT	8	1	3	Competent
19	ATC	OT	26	16	16	Expert
20	ATC	OT	3	1	3	Advanced Beginner

Appendix 9 continued

Participant	Location (ATC /BIU)	Profession	Years qualified	Experience with EAT	Experience with ABI	Expertise Self-Rating
21	ATC	SLT	8	5	4	Proficient
22	ATC	SLT	18	15	13	Expert
23	ATC	BE	15	15	15	Expert
24	ATC	SLT	25	9	9	Expert
25	BIU	SLT	8	6	5	Competent
26	BIU	OT	9	2	7	Advanced Beginner
27	BIU	OT	7	1	5	Beginner
28	BIU	OT	23	6	20	Advanced Beginner
29	BIU	OT	19	16	16	Proficient
30	ATC	SLT	30	29	29	Proficient
31	ATC	SLT	21	19	19	Proficient
32	ATC	SLT	27	18	27	Proficient
33	ATC	OT	21	12	20	Proficient
34	ATC	OT	18	15	17	Expert
35	ATC	BE	12	20	20	Expert
36	ATC	BE	19	19	19	Competent
37	BIU	OT	29	5	20	Beginner
38	BIU	SLT	11	11	11	Advanced Beginner
39	ATC	SLT	11	11	11	Expert
40	ATC	SLT	15	14	10	Proficient
41	BIU	SLT	7	7	7	Competent
42	BIU	SLT	11	8	8	Competent

Appendix 9 continued

Participant	Location (ATC /BIU)	Profession	Years qualified	Experience with EAT	Experience with ABI	Expertise Self-Rating
43	ATC	SLT	10	10	3	Competent
44	ATC	OT	13	8	10	Proficient
45	ATC	BE	9	9	4	Expert
46	ATC	BE	2	7	7	Proficient
47	ATC	BE	20	6	6	Proficient
48	ATC	BE	24	19	19	Expert
49	ATC	BE	29	3	3	Proficient
50	ATC	SLT	10	6	6	Expert
51	ATC	BE	13	10	10	Expert
52	ATC	BE	5	5	5	Proficient
53	ATC	BE	10	15	15	Expert
54	ATC	BE	25	20	12	Expert
55	ATC	BE	23	20	10	Proficient
56	ATC	BE	12	8	11	Expert
57	ATC	BE	18	2	2	Competent
58	ATC	BE	15	15	15	Proficient
59	ATC	BE	11	11	11	Expert
60	ATC	OT	14	2	13	Competent
61	BIU	OT	14	5	8	Competent

*EXCLUDED FROM DATA ANALYSIS DUE TO FAULTY RECORDING

Key: ATC – Assistive Technology Centre BIU – Brain Injury Unit

Appendix 10

Chi Square Results for Decision Making Process Codes, Hypothetico-Deductive Codes and Heuristic Codes

Decision Making Process Coding

Collect * EAT Experience Median

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	41.010[a]	44	.601
Likelihood Ratio	56.438	44	.099
Linear-by-Linear Association	.003	1	.958
N of Valid Cases	60		

a. 90 cells (100.0%) have expected count less than 5. The minimum expected count is .45.

Collect * ABI Experience Median

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	43.030[a]	44	.513
Likelihood Ratio	59.211	44	.062
Linear-by-Linear Association	.006	1	.936
N of Valid Cases	60		

a. 90 cells (100.0%) have expected count less than 5. The minimum expected count is .45.

Collect * Expertise

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	6.150[a]	4	.794
Likelihood Ratio	6.424	4	.373
Linear-by-Linear Association	101	1	.750
N of Valid Cases	60		

a. 90 cells (100.0%) have expected count less than 5. The minimum expected count is .33.

Appendix 10 continued

Collect * Randomisation

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	45.200[a]	44	.422
Likelihood Ratio	62.585	44	.034
Linear-by-Linear Association	1.313	1	.252
N of Valid Cases	60		

a. 90 cells (100.0%) have expected count less than 5. The minimum expected count is .50.

Collect * Setting

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	31.733[a]	44	.916
Likelihood Ratio	37.523	44	.744
Linear-by-Linear Association	.403	1	.526
N of Valid Cases	60		

a. 90 cells (100.0%) have expected count less than 5. The minimum expected count is .25.

Collect * Profession

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	86.400[a]	88	.528
Likelihood Ratio	99.104	88	.197
Linear-by-Linear Association	5.448	1	.020
N of Valid Cases	60		

a. 135 cells (100.0%) have expected count less than 5. The minimum expected count is .33.

Deduce * Visual Expertise Pattern

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	61.133[a]	66	.647
Likelihood Ratio	70.071	66	.343
Linear-by-Linear Association	.059	1	.808
N of Valid Cases	60		

a. 102 cells (100.0%) have expected count less than 5. The minimum expected count is .20.

Appendix 10 continued

Deduce * EAT Experience Median

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	37.441[a]	33	.273
Likelihood Ratio	50.124	33	.028
Linear-by-Linear Association	.150	1	.698
N of Valid Cases	60		

a. 68 cells (100.0%) have expected count less than 5. The minimum expected count is .45.

Deduce * ABI Experience Median

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	32.391[a]	33	.497
Likelihood Ratio	44.073	33	.094
Linear-by-Linear Association	.403	1	.525
N of Valid Cases	60		

a. 68 cells (100.0%) have expected count less than 5. The minimum expected count is .45.

Deduce * Expertise

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	36.000[a]	33	.330
Likelihood Ratio	45.655	33	.070
Linear-by-Linear Association	4.802	1	.028
N of Valid Cases	60		

a. 68 cells (100.0%) have expected count less than 5. The minimum expected count is .33.

Appendix 10 continued

Deduce * Randomisation

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	30.000[a]	33	.617
Likelihood Ratio	40.855	33	.164
Linear-by-Linear Association	2.202	1	.138
N of Valid Cases	60		

a. 68 cells (100.0%) have expected count less than 5. The minimum expected count is .50.

Appendix 10 continued

Deduce * Setting

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	34.222[a]	33	.409
Likelihood Ratio	39.526	33	.201
Linear-by-Linear Association	2.891	1	.089
N of Valid Cases	60		

a. 68 cells (100.0%) have expected count less than 5. The minimum expected count is .25.

Deduce * Profession

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	67.500[a]	66	.426
Likelihood Ratio	79.467	66	.123
Linear-by-Linear Association	.249	1	.618
N of Valid Cases	60		

a. 102 cells (100.0%) have expected count less than 5. The minimum expected count is .33.

Appendix 10 continued

Interpret * Visual Expertise Pattern

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	52.509[a]	46	.236
Likelihood Ratio	61.476	46	.063
Linear-by-Linear Association	.036	1	.849
N of Valid Cases	60		

a. 72 cells (100.0%) have expected count less than 5. The minimum expected count is .20.

Interpret * EAT Experience Median

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	19.192[a]	23	.690
Likelihood Ratio	24.388	23	.383
Linear-by-Linear Association	1.115	1	.291
N of Valid Cases	60		

a. 48 cells (100.0%) have expected count less than 5. The minimum expected count is .45.

Interpret * ABI Experience Median

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	19.596[a]	23	.666
Likelihood Ratio	25.435	23	.328
Linear-by-Linear Association	.006	1	.938
N of Valid Cases	60		

a. 48 cells (100.0%) have expected count less than 5. The minimum expected count is .45.

Appendix 10 continued

Interpret * Expertise

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	23.400[a]	23	.438
Likelihood Ratio	29.422	23	.167
Linear-by-Linear Association	.036	1	.849
N of Valid Cases	60		

a. 48 cells (100.0%) have expected count less than 5. The minimum expected count is .33.

Interpret * Randomisation

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	23.333[a]	23	.441
Likelihood Ratio	30.306	23	.141
Linear-by-Linear Association	3.380	1	.066
N of Valid Cases	60		

a. 48 cells (100.0%) have expected count less than 5. The minimum expected count is .50.

Appendix 10 continued

Interpret * Setting

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	21.511[a]	23	.550
Likelihood Ratio	25.158	23	.342
Linear-by-Linear Association	.000	1	.983
N of Valid Cases	60		

a. 48 cells (100.0%) have expected count less than 5. The minimum expected count is .25.

Appendix 10 continued

Interpret * Profession

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	36.200[a]	46	.849
Likelihood Ratio	44.873	46	.519
Linear-by-Linear Association	1.749	1	.186
N of Valid Cases	60		

a. 72 cells (100.0%) have expected count less than 5. The minimum expected count is .33.

Judge * Visual Expertise Pattern

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	57.662[a]	46	.116
Likelihood Ratio	65.180	46	.033
Linear-by-Linear Association	.027	1	.869
N of Valid Cases	60		

a. 72 cells (100.0%) have expected count less than 5. The minimum expected count is .20.

Judge * EAT Experience Median

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	19.894[a]	23	.648
Likelihood Ratio	25.998	23	.301
Linear-by-Linear Association	.238	1	.626
N of Valid Cases	60		

a. 48 cells (100.0%) have expected count less than 5. The minimum expected count is .45.

Appendix 10 continued

Judge * ABI Experience Median

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	20.760[a]	23	.596
Likelihood Ratio	27.586	23	.232
Linear-by-Linear Association	.024	1	.876
N of Valid Cases	60		

a. 48 cells (100.0%) have expected count less than 5. The minimum expected count is .45.

Judge * Expertise

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	25.457[a]	23	.327
Likelihood Ratio	32.307	23	.094
Linear-by-Linear Association	.303	1	.582
N of Valid Cases	60		

a. 48 cells (100.0%) have expected count less than 5. The minimum expected count is .33.

Judge * Randomisation

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	23.486[a]	23	.433
Likelihood Ratio	31.326	23	.115
Linear-by-Linear Association	.061	1	.805
N of Valid Cases	60		

a. 48 cells (100.0%) have expected count less than 5. The minimum expected count is .50.

Appendix 10 continued

Judge * Setting

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	25.575[a]	23	.321
Likelihood Ratio	29.492	23	.165
Linear-by-Linear Association	.205	1	.651
N of Valid Cases	60		

a. 46 cells (95.8%) have expected count less than 5. The minimum expected count is .25.

Judge * Profession

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	53.657[a]	46	.204
Likelihood Ratio	66.119	46	.027
Linear-by-Linear Association	.781	1	.377
N of Valid Cases	60		

a. 72 cells (100.0%) have expected count less than 5. The minimum expected count is .33.

Reason * Visual Expertise Pattern

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	42.489[a]	48	.697
Likelihood Ratio	50.328	48	.381
Linear-by-Linear Association	.328	1	.567
N of Valid Cases	60		

a. 75 cells (100.0%) have expected count less than 5. The minimum expected count is .20.

Appendix 10 continued

Reason * EAT Experience Median

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	23.107[a]	24	.513
Likelihood Ratio	31.060	24	.152
Linear-by-Linear Association	.781	1	.377
N of Valid Cases	60		

a. 50 cells (100.0%) have expected count less than 5. The minimum expected count is .45.

Reason * ABI Experience Median

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	24.060[a]	24	.458
Likelihood Ratio	31.060	24	.152
Linear-by-Linear Association	1.112	1	.292
N of Valid Cases	60		

a. 50 cells (100.0%) have expected count less than 5. The minimum expected count is .45.

Reason * Expertise

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	22.221[a]	24	.566
Likelihood Ratio	27.638	24	.276
Linear-by-Linear Association	1.260	1	.262
N of Valid Cases	60		

a. 50 cells (100.0%) have expected count less than 5. The minimum expected count is .33.

Appendix 10 continued

Reason * Randomisation

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	20.610[a]	24	.662
Likelihood Ratio	26.657	24	.321
Linear-by-Linear Association	3.439	1	.064
N of Valid Cases	60		

a. 50 cells (100.0%) have expected count less than 5. The minimum expected count is .50.

Reason * Setting

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	23.873[a]	24	.469
Likelihood Ratio	27.421	24	.285
Linear-by-Linear Association	.299	1	.584
N of Valid Cases	60		

a. 49 cells (98.0%) have expected count less than 5. The minimum expected count is .25.

Reason * Profession

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	50.100[a]	48	.390
Likelihood Ratio	58.677	48	.139
Linear-by-Linear Association	.979	1	.323
N of Valid Cases	60		

a. 75 cells (100.0%) have expected count less than 5. The minimum expected count is .33.

Appendix 10 continued

Reflect * Visual Expertise Pattern

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	60.492[a]	62	.530
Likelihood Ratio	68.712	62	.261
Linear-by-Linear Association	.000	1	.999
N of Valid Cases	60		

a. 96 cells (100.0%) have expected count less than 5. The minimum expected count is .20.

Reflect * EAT Experience Median

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	23.973[a]	31	.812
Likelihood Ratio	31.624	31	.435
Linear-by-Linear Association	3.534	1	.060
N of Valid Cases	60		

a. 64 cells (100.0%) have expected count less than 5. The minimum expected count is .45.

Reflect * ABI Experience Median

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	29.697[a]	31	.533
Likelihood Ratio	39.941	31	.130
Linear-by-Linear Association	.673	1	.412
N of Valid Cases	60		

a. 64 cells (100.0%) have expected count less than 5. The minimum expected count is .45.

Appendix 10 continued

Reflect * Expertise

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	33.750[a]	31	.336
Likelihood Ratio	43.111	31	.073
Linear-by-Linear Association	4.133	1	.042
N of Valid Cases	60		

a. 64 cells (100.0%) have expected count less than 5. The minimum expected count is .33.

Reflect * Randomisation

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	28.000[a]	31	.621
Likelihood Ratio	37.770	31	.187
Linear-by-Linear Association	.296	1	.586
N of Valid Cases	60		

a. 64 cells (100.0%) have expected count less than 5. The minimum expected count is .50.

Reflect * Setting

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	27.556[a]	31	.644
Likelihood Ratio	32.483	31	.394
Linear-by-Linear Association	.734	1	.392
N of Valid Cases	60		

a. 64 cells (100.0%) have expected count less than 5. The minimum expected count is .25.

Appendix 10 continued

Reflect * Profession

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	67.500[a]	62	.295
Likelihood Ratio	78.787	62	.074
Linear-by-Linear Association	.095	1	.758
N of Valid Cases	60		

a. 96 cells (100.0%) have expected count less than 5. The minimum expected count is .33.

Restate * Visual Expertise Pattern

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	33.009[a]	40	.775
Likelihood Ratio	41.102	40	.422
Linear-by-Linear Association	.485	1	.486
N of Valid Cases	60		

a. 63 cells (100.0%) have expected count less than 5. The minimum expected count is .20.

Restate * EAT Experience Median

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	18.393[a]	20	.562
Likelihood Ratio	24.102	20	.238
Linear-by-Linear Association	.055	1	.815
N of Valid Cases	60		

a. 42 cells (100.0%) have expected count less than 5. The minimum expected count is .45.

Appendix 10 continued

Restate * ABI Experience Median

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	25.127[a]	20	.197
Likelihood Ratio	32.925	20	.034
Linear-by-Linear Association	1.056	1	.304
N of Valid Cases	60		

a. 42 cells (100.0%) have expected count less than 5. The minimum expected count is .45.

Restate * Expertise

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	17.196[a]	20	.640
Likelihood Ratio	21.552	20	.365
Linear-by-Linear Association	.180	1	.671
N of Valid Cases	60		

a. 42 cells (100.0%) have expected count less than 5. The minimum expected count is .33.

Restate * Randomisation

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	16.476[a]	20	.687
Likelihood Ratio	21.250	20	.383
Linear-by-Linear Association	1.201	1	.273
N of Valid Cases	60		

a. 42 cells (100.0%) have expected count less than 5. The minimum expected count is .50.

Appendix 10 continued

Restate * Setting

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	20.317[a]	20	.438
Likelihood Ratio	23.969	20	.244
Linear-by-Linear Association	1.658	1	.198
N of Valid Cases	60		

a. 41 cells (97.6%) have expected count less than 5. The minimum expected count is .25.

Restate * Profession

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	35.643[a]	40	.667
Likelihood Ratio	43.906	40	.309
Linear-by-Linear Association	1.543	1	.214
N of Valid Cases	60		

a. 63 cells (100.0%) have expected count less than 5. The minimum expected count is .33.

Formulate * Visual Expertise Pattern

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	86.282[a]	82	.352
Likelihood Ratio	99.210	82	.095
Linear-by-Linear Association	.408	1	.523
N of Valid Cases	60		

a. 126 cells (100.0%) have expected count less than 5. The minimum expected count is .20.

Appendix 10 continued

Formulate * EAT Experience Median

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	38.788[a]	41	.569
Likelihood Ratio	52.758	41	.103
Linear-by-Linear Association	1.423	1	.233
N of Valid Cases	60		

a. 84 cells (100.0%) have expected count less than 5. The minimum expected count is .45.

Formulate * ABI Experience Median

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	38.788[a]	41	.569
Likelihood Ratio	52.758	41	.103
Linear-by-Linear Association	.893	1	.345
N of Valid Cases	60		

a. 84 cells (100.0%) have expected count less than 5. The minimum expected count is .45.

Formulate * Expertise

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	41.625[a]	41	.443
Likelihood Ratio	53.154	41	.097
Linear-by-Linear Association	.936	1	.333
N of Valid Cases	60		

a. 84 cells (100.0%) have expected count less than 5. The minimum expected count is .33.

Appendix 10 continued

Formulate * Randomisation

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	43.667[a]	41	.359
Likelihood Ratio	59.950	41	.028
Linear-by-Linear Association	1.288	1	.256
N of Valid Cases	60		

a. 84 cells (100.0%) have expected count less than 5. The minimum expected count is .50.

Formulate * Setting

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	43.556[a]	41	.363
Likelihood Ratio	49.798	41	.163
Linear-by-Linear Association	.014	1	.907
N of Valid Cases	60		

a. 84 cells (100.0%) have expected count less than 5. The minimum expected count is .25.

Formulate * Profession

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	80.500[a]	82	.526
Likelihood Ratio	92.650	82	.198
Linear-by-Linear Association	5.789	1	.016
N of Valid Cases	60		

a. 126 cells (100.0%) have expected count less than 5. The minimum expected count is .33.

Appendix 10 continued

Prescribe * Visual Expertise Pattern

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	30.496[a]	38	.802
Likelihood Ratio	36.948	38	.518
Linear-by-Linear Association	3.001	1	.083
N of Valid Cases	60		

a. 60 cells (100.0%) have expected count less than 5. The minimum expected count is .20.

Prescribe * EAT Experience Median

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	12.881[a]	19	.845
Likelihood Ratio	16.357	19	.633
Linear-by-Linear Association	.000	1	.993
N of Valid Cases	60		

a. 40 cells (100.0%) have expected count less than 5. The minimum expected count is .45.

Prescribe * ABI Experience Median

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	18.942[a]	19	.461
Likelihood Ratio	24.813	19	.167
Linear-by-Linear Association	2.466	1	.116
N of Valid Cases	60		

a. 40 cells (100.0%) have expected count less than 5. The minimum expected count is .45.

Appendix 10 continued

Prescribe * Expertise

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	30.996[a]	19	.040
Likelihood Ratio	37.682	19	.007
Linear-by-Linear Association	.440	1	.507
N of Valid Cases	60		

a. 40 cells (100.0%) have expected count less than 5. The minimum expected count is .33.

Prescribe * Randomisation

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	18.448[a]	19	.493
Likelihood Ratio	23.550	19	.214
Linear-by-Linear Association	.067	1	.796
N of Valid Cases	60		

a. 40 cells (100.0%) have expected count less than 5. The minimum expected count is .50.

Prescribe * Setting

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	23.251[a]	19	.226
Likelihood Ratio	27.054	19	.103
Linear-by-Linear Association	.284	1	.594
N of Valid Cases	60		

a. 38 cells (95.0%) have expected count less than 5. The minimum expected count is .25.

Appendix 10 continued

Prescribe * Profession

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	40.229[a]	38	.372
Likelihood Ratio	47.252	38	.144
Linear-by-Linear Association	.549	1	.459
N of Valid Cases	60		

a. 60 cells (100.0%) have expected count less than 5. The minimum expected count is .33.

Total Segments * Visual Expertise Pattern

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	97.710[a]	96	.432
Likelihood Ratio	105.802	96	.232
Linear-by-Linear Association	.405	1	.525
N of Valid Cases	60		

a. 147 cells (100.0%) have expected count less than 5. The minimum expected count is .20.

Total Segments * EAT Experience Median

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	41.145[a]	48	.748
Likelihood Ratio	56.577	48	.185
Linear-by-Linear Association	.600	1	.438
N of Valid Cases	60		

a. 98 cells (100.0%) have expected count less than 5. The minimum expected count is .45.

Appendix 10 continued

Total Segments * ABI Experience Median

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	45.859[a]	48	.561
Likelihood Ratio	63.169	48	.070
Linear-by-Linear Association	.226	1	.634
N of Valid Cases	60		

a. 98 cells (100.0%) have expected count less than 5. The minimum expected count is .45.

Total Segments * Expertise

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	48.000[a]	48	.473
Likelihood Ratio	61.472	48	.092
Linear-by-Linear Association	2.040	1	.153
N of Valid Cases	60		

a. 98 cells (100.0%) have expected count less than 5. The minimum expected count is .33.

Total Segments * Randomisation

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	49.333[a]	48	.420
Likelihood Ratio	68.268	48	.029
Linear-by-Linear Association	.034	1	.853
N of Valid Cases	60		

a. 98 cells (100.0%) have expected count less than 5. The minimum expected count is .50.

Appendix 10 continued

Total Segments * Setting

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	45.778[a]	48	.564
Likelihood Ratio	52.571	48	.302
Linear-by-Linear Association	.083	1	.774
N of Valid Cases	60		

a. 98 cells (100.0%) have expected count less than 5. The minimum expected count is .25.

Total Segments * Profession

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	108.000[a]	96	.189
Likelihood Ratio	120.743	96	.045
Linear-by-Linear Association	4.651	1	.031
N of Valid Cases	60		

a. 147 cells (100.0%) have expected count less than 5. The minimum expected count is .33.

Appendix 10 continued

Hypothetico-Deductive Model Coding

Cue Acquisition * Profession

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	76.800[a]	76	.453
Likelihood Ratio	88.693	76	.151
Linear-by-Linear Association	2.695	1	.101
N of Valid Cases	60		

a. 117 cells (100.0%) have expected count less than 5. The minimum expected count is .33.

Cue Acquisition * Setting

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	39.733[a]	38	.393
Likelihood Ratio	45.474	38	.189
Linear-by-Linear Association	2.510	1	.113
N of Valid Cases	60		

a. 78 cells (100.0%) have expected count less than 5. The minimum expected count is .25.

Cue Acquisition * Self-rated expertise

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	41.100[a]	38	.336
Likelihood Ratio	52.649	38	.057
Linear-by-Linear Association	2.173	1	.140
N of Valid Cases	60		

a. 78 cells (100.0%) have expected count less than 5. The minimum expected count is .33.

Appendix 10 continued

Cue Acquisition * ABI Experience Median

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	34.276[a]	38	.642
Likelihood Ratio	46.166	38	.170
Linear-by-Linear Association	1.437	1	.231
N of Valid Cases	60		

a. 78 cells (100.0%) have expected count less than 5. The minimum expected count is .45.

Cue Acquisition * EAT Experience Median

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	37.643[a]	38	.486
Likelihood Ratio	51.573	38	.070
Linear-by-Linear Association	.379	1	.538
N of Valid Cases	60		

a. 78 cells (100.0%) have expected count less than 5. The minimum expected count is .45.

Cue Implication * Profession

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	43.773[a]	34	.122
Likelihood Ratio	52.575	34	.022
Linear-by-Linear Association	1.003	1	.317
N of Valid Cases	60		

a. 54 cells (100.0%) have expected count less than 5. The minimum expected count is .33.

Appendix 10 continued

Cue Implication * Setting

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	15.277[a]	17	.576
Likelihood Ratio	19.109	17	.322
Linear-by-Linear Association	1.014	1	.314
N of Valid Cases	60		

a. 34 cells (94.4%) have expected count less than 5. The minimum expected count is .25.

Cue Implication * Self-rated expertise

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	14.765[a]	17	.612
Likelihood Ratio	20.002	17	.274
Linear-by-Linear Association	.624	1	.429
N of Valid Cases	60		

a. 34 cells (94.4%) have expected count less than 5. The minimum expected count is .33.

Cue Implication * ABI Experience Median

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	16.556[a]	17	.485
Likelihood Ratio	21.872	17	.190
Linear-by-Linear Association	3.511	1	.061
N of Valid Cases	60		

a. 35 cells (97.2%) have expected count less than 5. The minimum expected count is .45.

Cue Implication * EAT Experience Median

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	16.590[a]	17	.482
Likelihood Ratio	21.367	17	.210
Linear-by-Linear Association	.004	1	.948
N of Valid Cases	60		

a. 35 cells (97.2%) have expected count less than 5. The minimum expected count is .45.

Cue Interpretation * Profession

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	20.218[a]	16	.211
Likelihood Ratio	22.340	16	.133
Linear-by-Linear Association	.001	1	.979
N of Valid Cases	58		

a. 24 cells (88.9%) have expected count less than 5. The minimum expected count is .33.

Cue Interpretation * Setting

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	10.630[a]	8	.224
Likelihood Ratio	13.135	8	.107
Linear-by-Linear Association	2.174	1	.140
N of Valid Cases	58		

a. 15 cells (83.3%) have expected count less than 5. The minimum expected count is .24.

Appendix 10 continued

Cue Interpretation * Self-rated expertise

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	6.848[a]	8	.553
Likelihood Ratio	9.052	8	.338
Linear-by-Linear Association	1.739	1	.187
N of Valid Cases	58		

a. 14 cells (77.8%) have expected count less than 5. The minimum expected count is .31.

Cue Interpretation * ABI Experience Median

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	17.269[a]	8	.027
Likelihood Ratio	19.373	8	.013
Linear-by-Linear Association	1.229	1	.268
N of Valid Cases	58		

a. 13 cells (72.2%) have expected count less than 5. The minimum expected count is .43.

Cue Interpretation * EAT Experience Median

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	11.148[a]	8	.193
Likelihood Ratio	12.962	8	.113
Linear-by-Linear Association	2.846	1	.092
N of Valid Cases	58		

a. 13 cells (72.2%) have expected count less than 5. The minimum expected count is .45.

Appendix 10 continued

Hypothesis Evaluation * ABI Experience Median

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	5.088[a]	6	.533
Likelihood Ratio	5.513	6	.480
Linear-by-Linear Association	1.292	1	.256
N of Valid Cases	60		

a. 9 cells (64.3%) have expected count less than 5. The minimum expected count is .45.

Hypothesis Evaluation * Profession

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	19.030[a]	12	.088
Likelihood Ratio	20.694	12	.055
Linear-by-Linear Association	3.760	1	.052
N of Valid Cases	60		

a. 18 cells (85.7%) have expected count less than 5. The minimum expected count is .33.

Hypothesis Evaluation * Setting

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	2.887[a]	6	.823
Likelihood Ratio	3.359	6	.763
Linear-by-Linear Association	.068	1	.794
N of Valid Cases	60		

a. 9 cells (64.3%) have expected count less than 5. The minimum expected count is .25.

Appendix 10 continued

Hypothesis Evaluation * Self-rated expertise

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	4.632[a]	6	.592
Likelihood Ratio	4.961	6	.549
Linear-by-Linear Association	.026	1	.873
N of Valid Cases	60		

a. 9 cells (64.3%) have expected count less than 5. The minimum expected count is .33.

Hypothesis Evaluation * EAT Experience Median

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	8.633[a]	6	.195
Likelihood Ratio	10.222	6	.116
Linear-by-Linear Association	.052	1	.820
N of Valid Cases	60		

a. 9 cells (64.3%) have expected count less than 5. The minimum expected count is .45.

Hypothesis Generation * Profession

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	41.136[a]	44	.595
Likelihood Ratio	51.268	44	.210
Linear-by-Linear Association	.275	1	.600
N of Valid Cases	60		

a. 69 cells (100.0%) have expected count less than 5. The minimum expected count is .33.

Appendix 10 continued

Hypothesis Generation * Setting

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	14.413[a]	22	.886
Likelihood Ratio	18.459	22	.678
Linear-by-Linear Association	3.199	1	.074
N of Valid Cases	60		

a. 44 cells (95.7%) have expected count less than 5. The minimum expected count is .25.

Hypothesis Generation * Self-rated expertise

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	17.486[a]	22	.736
Likelihood Ratio	22.862	22	.410
Linear-by-Linear Association	4.367	1	.037
N of Valid Cases	60		

a. 45 cells (97.8%) have expected count less than 5. The minimum expected count is .33.

Hypothesis Generation * ABI Experience Median

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	30.746[a]	22	.101
Likelihood Ratio	39.606	22	.012
Linear-by-Linear Association	.967	1	.326
N of Valid Cases	60		

a. 46 cells (100.0%) have expected count less than 5. The minimum expected count is .45.

Appendix 10 continued

Hypothesis Generation * EAT Experience Median

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	28.302[a]	22	.166
Likelihood Ratio	36.834	22	.025
Linear-by-Linear Association	.082	1	.774
N of Valid Cases	60		

a. 46 cells (100.0%) have expected count less than 5. The minimum expected count is .45.

Hypothesis Implementation * Profession

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	5.804[a]	6	.445
Likelihood Ratio	6.386	6	.381
Linear-by-Linear Association	1.169	1	.280
N of Valid Cases	60		

a. 9 cells (75.0%) have expected count less than 5. The minimum expected count is .33.

Hypothesis Implementation * Setting

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	4.039[a]	3	.257
Likelihood Ratio	4.034	3	.258
Linear-by-Linear Association	1.965	1	.161
N of Valid Cases	60		

a. 5 cells (62.5%) have expected count less than 5. The minimum expected count is .25.

Appendix 10 continued

Hypothesis Implementation * Self-rated expertise

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	3.049[a]	3	.384
Likelihood Ratio	3.547	3	.315
Linear-by-Linear Association	1.194	1	.275
N of Valid Cases	60		

a. 5 cells (62.5%) have expected count less than 5. The minimum expected count is .33.

Hypothesis Implementation * ABI Experience Median

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	3.112[a]	3	.375
Likelihood Ratio	3.879	3	.275
Linear-by-Linear Association	.359	1	.549
N of Valid Cases	60		

a. 4 cells (50.0%) have expected count less than 5. The minimum expected count is .45.

Hypothesis Implementation * EAT Experience Median

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	6.801[a]	3	.079
Likelihood Ratio	7.994	3	.046
Linear-by-Linear Association	.083	1	.773
N of Valid Cases	60		

a. 4 cells (50.0%) have expected count less than 5. The minimum expected count is .45.

Appendix 10 continued

Heuristc Coding

Representativeness Heuristic * ABI Experience Median

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	7.205[a]	5	.206
Likelihood Ratio	8.851	5	.115
Linear-by-Linear Association	.038	1	.844
N of Valid Cases	60		

a. 7 cells (58.3%) have expected count less than 5. The minimum expected count is .45.

Representativeness Heuristic * EAT Experience Median

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	3.300[a]	5	.654
Likelihood Ratio	3.789	5	.580
Linear-by-Linear Association	.003	1	.959
N of Valid Cases	60		

a. 7 cells (58.3%) have expected count less than 5. The minimum expected count is .45.

Representativeness Heuristic * Profession

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	10.327[a]	10	.412
Likelihood Ratio	12.656	10	.244
Linear-by-Linear Association	.196	1	.658
N of Valid Cases	60		

a. 15 cells (83.3%) have expected count less than 5. The minimum expected count is .33.

Appendix 10 continued

Representativeness Heuristic * Setting

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	4.229[a]	5	.517
Likelihood Ratio	6.349	5	.274
Linear-by-Linear Association	3.527	1	.060
N of Valid Cases	60		

a. 8 cells (66.7%) have expected count less than 5. The minimum expected count is .25.

Representativeness Heuristic * Self-rated expertise

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	7.717[a]	5	.173
Likelihood Ratio	10.467	5	.063
Linear-by-Linear Association	5.058	1	.025
N of Valid Cases	60		

a. 8 cells (66.7%) have expected count less than 5. The minimum expected count is .33.

Anchoring & Adjustment Heuristic * ABI Experience Median

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	3.962[a]	5	.555
Likelihood Ratio	5.132	5	.400
Linear-by-Linear Association	1.380	1	.240
N of Valid Cases	60		

a. 10 cells (83.3%) have expected count less than 5. The minimum expected count is .45.

Appendix 10 continued

Anchoring & Adjustment Heuristic * EAT Experience Median

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	6.992[a]	5	.221
Likelihood Ratio	9.631	5	.086
Linear-by-Linear Association	2.840	1	.092
N of Valid Cases	60		

a. 10 cells (83.3%) have expected count less than 5. The minimum expected count is .45.

Anchoring & Adjustment Heuristic * Profession

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	10.683[a]	10	.383
Likelihood Ratio	12.110	10	.278
Linear-by-Linear Association	2.929	1	.087
N of Valid Cases	60		

a. 15 cells (83.3%) have expected count less than 5. The minimum expected count is .33.

Anchoring & Adjustment Heuristic * Setting

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	1.067[a]	5	.957
Likelihood Ratio	1.792	5	.877
Linear-by-Linear Association	.775	1	.379
N of Valid Cases	60		

a. 9 cells (75.0%) have expected count less than 5. The minimum expected count is .25.

Appendix 10 continued

Anchoring & Adjustment Heuristic * Self-rated expertise

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	3.475[a]	5	.627
Likelihood Ratio	4.312	5	.505
Linear-by-Linear Association	.008	1	.928
N of Valid Cases	60		

a. 9 cells (75.0%) have expected count less than 5. The minimum expected count is .33.

Availability Heuristic * Profession

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	12.358[a]	10	.262
Likelihood Ratio	13.575	10	.193
Linear-by-Linear Association	1.127	1	.288
N of Valid Cases	60		

a. 12 cells (66.7%) have expected count less than 5. The minimum expected count is .33.

Availability Heuristic * Setting

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	1.695[a]	5	.890
Likelihood Ratio	2.172	5	.825
Linear-by-Linear Association	1.566	1	.211
N of Valid Cases	60		

a. 8 cells (66.7%) have expected count less than 5. The minimum expected count is .25.

Appendix 10 continued

Availability Heuristic * ABI Experience Median

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	3.804[a]	5	.578
Likelihood Ratio	4.596	5	.467
Linear-by-Linear Association	.685	1	.408
N of Valid Cases	60		

a. 7 cells (58.3%) have expected count less than 5. The minimum expected count is .45.

Availability Heuristic * EAT Experience Median

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	3.130[a]	5	.680
Likelihood Ratio	3.916	5	.562
Linear-by-Linear Association	.154	1	.695
N of Valid Cases	60		

a. 7 cells (58.3%) have expected count less than 5. The minimum expected count is .45.

Availability Heuristic * Self-rated expertise

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	2.329[a]	5	.802
Likelihood Ratio	3.010	5	.698
Linear-by-Linear Association	1.503	1	.220
N of Valid Cases	60		

a. 7 cells (58.3%) have expected count less than 5. The minimum expected count is .33.

APPENDIX 11

ANOVA Results for Decision Making Strategy Codes and Randomisation and Total Segments Coded

ANOVA Table for Total Segments Coded

			Sum of Squares	df	Mean Square	F	Sig.
Case A Collect * Case B Collect	Between Groups	(Combined)	92.843	39	2.381	1.351	.238
		Linearity	5.943	1	5.943	3.372	.081
		Deviation from Linearity	86.900	38	2.287	1.298	.271
	Within Groups		35.242	20	1.762		
	Total		128.085	59			

			Sum of Squares	df	Mean Square	F	Sig.
Case A Deduce * Case B Deduce	Between Groups	(Combined)	37.006	26	1.423	1.154	.345
		Linearity	.025	1	.025	.021	.887
		Deviation from Linearity	36.980	25	1.479	1.199	.309
	Within Groups		40.716	33	1.234		
	Total		77.721	59			

			Sum of Squares	df	Mean Square	F	Sig.
Case A Interpret * Case B Interpret	Between Groups	(Combined)	3.858	15	.257	.228	.998
		Linearity	.013	1	.013	.012	.914
		Deviation from Linearity	3.845	14	.275	.244	.997
	Within Groups		49.614	44	1.128		
	Total		53.473	59			

Appendix 11 continued

			Sum of Squares	df	Mean Square	F	Sig.
Case A Judge * Case B Judge	Between Groups	(Combined)	15.924	17	.937	1.063	.418
		Linearity	.668	1	.668	.758	.389
		Deviation from Linearity	15.256	16	.954	1.082	.401
	Within Groups		37.022	42	.881		
	Total		52.947	59			

			Sum of Squares	df	Mean Square	F	Sig.
Case A Predict * Case B Predict	Between Groups	(Combined)	1.412	2	.706	1.593	.212
		Linearity	1.372	1	1.372	3.097	.084
		Deviation from Linearity	.040	1	.040	.090	.766
	Within Groups		25.251	57	.443		
	Total		26.663	59			

			Sum of Squares	df	Mean Square	F	Sig.
Case A Reason * Case B Reason	Between Groups	(Combined)	14.750	17	.868	1.241	.277
		Linearity	2.581	1	2.581	3.691	.062
		Deviation from Linearity	12.169	16	.761	1.088	.396
	Within Groups		29.363	42	.699		
	Total		44.113	59			

Appendix 11 continued

			Sum of Squares	df	Mean Square	F	Sig.
Case A Reflect * Case B Reflect	Between Groups	(Combined)	35.400	28	1.264	.793	.731
		Linearity	.005	1	.005	.003	.958
		Deviation from Linearity	35.395	27	1.311	.822	.695
	Within Groups		49.416	31	1.594		
	Total		84.815	59			

			Sum of Squares	df	Mean Square	F	Sig.
Case A Restate * Case B Restate	Between Groups	(Combined)	9.441	14	.674	.465	.940
		Linearity	.069	1	.069	.048	.828
		Deviation from Linearity	9.372	13	.721	.497	.915
	Within Groups		65.269	45	1.450		
	Total		74.710	59			

			Sum of Squares	df	Mean Square	F	Sig.
Case A Review * Case B Review	Between Groups	(Combined)	.076	2	.038	.119	.888
		Linearity	.068	1	.068	.214	.646
		Deviation from Linearity	.008	1	.008	.025	.876
	Within Groups		17.769	56	.317		
	Total		17.844	58			

Appendix 11 continued

			Sum of Squares	df	Mean Square	F	Sig.
Case A Formulate * Case B Formulate	Between Groups	(Combined)	69.446	33	2.104	1.201	.318
		Linearity	.033	1	.033	.019	.892
		Deviation from Linearity	69.413	32	2.169	1.238	.291
	Within Groups		45.562	26	1.752		
	Total		115.008	59			

			Sum of Squares	df	Mean Square	F	Sig.
Case A Prescribe * Case B Prescribe	Between Groups	(Combined)	16.044	13	1.234	1.596	.121
		Linearity	2.414	1	2.414	3.122	.084
		Deviation from Linearity	13.630	12	1.136	1.469	.171
	Within Groups		35.566	46	.773		
	Total		51.610	59			

			Sum of Squares	df	Mean Square	F	Sig.
Case A Total Segments * Case B Total Segments	Between Groups	(Combined)	240.605	51	4.718	1.274	.382
		Linearity	.537	1	.537	.145	.713
		Deviation from Linearity	240.068	50	4.801	1.296	.371
	Within Groups		29.636	8	3.705		
	Total		270.242	59			

APPENDIX 12

Discard Coding

PARTICIPANT	STATEMENTS CODED AS DISCARD for CASE A
2	When that happens XXX but presupposes that XXX
3	Oh golly Golly, the names have even gone now. Yes, but also the actual software package itself. I can't remember the name of right this minute. Can't remember. It's not really an answer for you. I don't know.
4	We didn't, ah, see, well, Because it's— That's the flavour of it.
5	But some of his behaviour we were always informed that we weren't sure whether he was like it in the first place and it had nothing to do at all with his incident. He's got..,
6	Gosh x2
7	Yes. Can I make some notes, first.
8	sorry I'm just reading its hard to talk and read at the same time, Oh dear, oh this ones quite abit more (laughs) abit tricky, really. Okay, okay, umm, umm, ooh I'm getting really stumped (laughs).
9	Am I able to ask you questions now?
10	Ah goodness Is it … I wonder if he … Okay It would be interesting to see ….

	What were they messing about at? Why didn't they think of this beforehand. (LAUGHS) am, I'm assuming that he's.. as I'm not a speech therapist, do you want me to answer these as if I'm the OT in the grand scheme of things Again, I have a vivid imagination. (laughs)
11	Crumbs
12	Erm But I mean he .. that, that, that, I mean there,
13	crikey. But trying to listen to this as well, at the same time. That's an interesting word to use, isn't it. Kind of drying up.
14	Could I ask that? I hope that's explained it enough. On our own referral forms and things here we have it laid out quite differently and we are used to that and over the years we've been using the same referral forms for ten years and we have a tick box system about left upper limb and right upper limb and is that due to different reasons. sometimes the language you get used to using in one setting might be slightly different and thinking, what does that mean? Where is Wikipedia when I need it.
18	Great Wow So, wow
19	Do you want me to just keep talking?
21	Am I explaining rather than Okay. Losing my train of thought completely. Really jumping around.

22	am I allowed to say that? Sorry, I interrupted what you were saying. The actual computer software certainly isn't what I specialise in .That would actually probably be an appointment if it came through. The way we work is that the OTs look more at the physical position. The clinical scientists look more at the computer software side of things and the speech therapist look at the communication side. So, it would possibly be one that we'd go to see with myself and—it says, computer, so it maybe a clinical scientist or it maybe a combination of three people. Is that as much as you need to me to do? Do you need more than that?
23	I'm not sure what the term is I still can't remember the name of that head rest. Can you remember the name of it? It's got XXX at the back and elastic… I can't remember the name of it. The other one that I can't remember the name of. I nearly remembered the name of that.
24	and at the moment I've just allowed my eyes to glance down further, Me worrying about her and all the rest of it may not help Comes from a part of the world I really don't know anything about. I don't know about his religion and what that means. Poor chap. That's really … that's horrible It's not fair, is it? ..which we'll hear some more about, no doubt. ..like the sheet says What a bummer. They've done it surprisingly fast for what actually happens. (LAUGHS) It's a bit of an ideal world, isn't it. Bungalow in central London, that would be interesting. Right. His poor mum, she's got enough disruption as it is with

	moving house and everything.
25	She’s got … OK … So that’s a bit embarrassing for a speech therapist. Speech therapist forget to listen to the speech sample. Right, start again. Yeah sorry I’m losing my train of thought a bit. I know that I’m not going to remember the names of them straight away
26	okay fair dos. fab. Cool, I’m not very up to date with what there is? I don’t know what the latest things are really
28	Amm., just trying to think, really. You could…. Am…so those are the kind of practical things that I think of. my first thing would be that … And amm, most probably, amm That it, amm, doesn’t matter Amm…That’s really …
31	I’ve not had to do that for anyone. More typically, Word Processing, web browsing.
32	I actually just recently, this week went to some sessions where they were talking about, physios were talking about how if somebody’s muscles lengthen, then, they are very difficult to shorten again, so that it’s not a good idea to let somebody sit with their head forward, because it’s very difficult to shorten the muscles, again. So that’s a new bit of knowledge for me, it’s a big debate we are having internally at the moment about what we should and what we can. It’s all to do with resources as well as skill mix and abilities.

	Right. I recognise the last one. I happen to know what lower motor neurone means.
33	I thought I'd spotted her later on. so that's a year. I hope the lift works well I think in terms I've just been to a conference recently and there are other systems about, so that in terms of how well they work at the moment. We'll need to see—the Dynabox looks reasonably reliable, but again, it's how it will collaborate I'm not quite sure how much they are still supporting it or marketing it on the community. I kind of got the impression that it might not be on the market
34	Okay Great I'm wondering where this is. We must have moved there Okay Okay There is certainly a possibility for his..
35	Quickly scan But the person or the previous XXX may spend time alone, it's certainly going to be more essential and have to come into the picture.
36	Right Right
37	Okay. I'm not sure. Those are the four different areas, I'm just thinking aloud about those things.
38	Both of these patients, I should not be thinking about this now, I should have been thinking about it when they came in. Dysarthria My word.

	We have sections lost and found.
39	Oh, blimey Okay Okay Okay Blimey Right My word. Oh dear. Okay Oh no Okay What did I say, looking at his socks. I don't know what's possible. My word. Poor guy. Okay. Okay. Right. That one would hope is not going to get nicked. Oh god. I'm wanting him to try those. I'm just thinking about all the things I didn't say on the first case study. Never mind. Have I done that right? Obviously, haven't covered everything.
40	Mm.. (reading under breath) (0.7) Mm, okay, right. To see if English is his first language and it is. Mm (0.2) Right, mm .. Okay Okay. Okay. Okay. Is he quite… Well, ah… Right, okay then.
41	Okay. Okay.

	Okay. Okay. Okay. Okay. Okay. Right. Let me think. Okay I don’t know, exactly. I don’t know. Hope that there was. I don’t know. I don’t think—I’ve not had anyone whose—again, maybe. Let me think. well, I don’t know. I don’t know. I don’t know. Well, if, when I was working in Australia, I would refer them on, anybody that needs the communication device, because there would be those people that would provide it so I would do that. Then I would leave the problem solving to them, really. Especially if I felt that there was something that wasn’t straightforward in terms of access, especially. I would do that. Otherwise, here, I guess, I would try to move people on and it’s just never happened and you feel like you are waiting forever, but I’d be getting—
42	so again wow, umm, Erm I think that’s it.
43	Let me just go back. Oh, my goodness. That’s better. Let me just write this down. If he could, not sure.

	just thinking about loud.
44	I'm flicking down already to his diagnosis or if that sounds a funny thing to say. and I would imagine for him and I'm saying I'd imagine and obviously if I met him. I suppose it really depends—my normal way of working is thinking about offering someone the opportunity to see different methods and then the different methods I think they would be able to use and then working from there to see what's acceptable to them and what's not, really. There are all sorts of systems out there that eye gaze system and all these things. I have just done an essay about this whole business about tilting and reclining and people engaging If I could see more of that I would probably be looking at that as well. Horses for courses kind of thing. Something along those lines. I think—just trying to picture him.
45	This is the information I get from the referral, so need to think about that. I wonder if it says later on in the form. No it's not. Okay. If we start again. I'll have a look at that in a second Okay See the beginning again Thinking back to another client, similar age, similar motivations Previous thought was that nothing had been tried with him till this point and some things have been and he's got a single reliable switch position So I'm trying to think of this as an assessment as I was going alone That's quite tricky. It's not happening. Found out his history

46	Mmm thinking about my first teenage date (laughs). I can’t read today. (laughs) Mmm, and…… In terms of, but I would consider putting some, Yeah, I’m not sure it’s very inspired.
47	We are looking at Not at all.
48	If that was successful, I will have a look at Jordan now. They can control that quite well. There is a motivational component to your decision making process. Give him a carrot to go for. The Grid itself is popular. If, yeah, okay. Scrap everything I’ve just said. Right. Again, I’m only going on experience of what I think he would use or would not use. Again, I’ve come across a number of people who have been injured in the teams and now I know them 20 years on and they don’t use communication. That’s my thought process on that.
49	Yes, I could do that. Our department has just started moving towards that. Right.
50	That is something that I’m now used to seeing more. It’s an area which I think is increasing. Let’s go back to this for a second Particularly, I often find with young men, it’s very difficult for them to have lots of women coming in to tell them what to do all the time. I do tend to get a bit of a huffy teenage attitude. But I wouldn’t really expect anything else from most young men.

	but particularly Carbamazapine which is one of the older anti convulsants But again, it’s only a very short little section there.
51	That is what is going through my mind at the moment From what I’ve read so far I don’t know. Okay. Used to have that myself in the past, so I know what that’s like. I don’t know. Okay. because I had one of those myself. I don’t know what the others do. Okay. Right. Okay. Right Right, okay. Okay. At the moment, I don’t see the— Okay. That would be good. And then we assume.. Right.
52	Right Okay. Okay Okay. Right, okay. It seems that getting him—
53	Okay Okay. Right, okay.

	It seems that getting him—
54	It maybe that—
55	Medications the only thing I recognize there is the salbutamol inhaler. Cos I used it myself as a child. No idea what the other ones are. That would be useful. has severe the video again. I suspect that the more I can add to that. He would use that
56	Have to see. Usually, pretty well received when we go and see somebody. We are there to try and help. I'd probably look up and refresh myself on something affecting lower motor neurone impact on speech. I've worked with a lot of people with dysarthric speech, so perhaps along similar lines to—one or two people I've got in mind, but I won't tell you their names. I've got one or two people in mind still, because of this. Find out about his current— I've got quite a good mental picture of referral. if that's what we are looking at. Kind of have that in mind I think when I went to see him. If that can be done on demand, we might be able to do something about that I think that's it, really.
57	Okay can't say that one. which can be ideally I won't say the name I think that should do it.

58	I think that should do it. Never heard of that. Never heard of that before. Fantastic observation. I have to say that at that point, the communication stuff disappears out my head. That’s not my area of expertise. and he’s going to XXX maybe it seems having output. I don’t know if you can get a communication aid with Uruba output.
59	Okay That’s not necessarily what’s going on in the old brain.
60	Okay. I don’t know… And does it say anything about— That would be what I would be suggesting, we wouldn’t be providing the computer equipment or even recommending it.
61	Okay. Let’s have a look I don’t know enough about that specifically That’s straightforward Ultimately, we’ve got a little bit of, just so I’m looking at that let me have a look back on here, does it say? (whispers) I don’t know what’s available How you would do that I don’t know I’ve no idea I’m quite limited with the knowledge base that I have with regards to the type of communication aid. I’m familiar with things like a light writer and that kind of thing, but of course Again, I don’t know

[redacted]	and I don’t know, I haven’t had a client in my experience, I’m not sure where to go I think this is quite specific for me. The baseline will be very straightforward I’m just thinking need and again I don’t know the range or the scope of equipment out there, Developing that idea if you want my thought processes

APPENDIX 12 continued

PARTICIPANT	STATEMENTS CODED AS DISCARD for CASE B
2	I need to look up what they were for. Without seeing further information, I'm seeing the same as before. Haven't actually checked the switching site, yet that's available mechanical options Yes, okay.
3	Right Whether she would need to be—
4	You might tell me that in a minute.
5	She's not … complex
6	She would … not sure Okay. That's it. I think that would be it.
7	Okay Okay. . I wish I had other things to say about that I'm being quite sporadic again not explaining this very well—

8	erm, Okay. Okay, okay, okay, Okay, Okay, okay, okay that’s fine Uh ha, uh ha, Okay Okay. Okay, right, okay. or okay, can I stop that now? Okay, okay sorry, okay because, yeah, maybe, but again, Okay, in summary so I think II would look at that and then I would so, I, I, and
9	okay, Okay, okay. Okay. Okay. Okay. Okay. Okay. Okay. Okay, Okay. Okay.
10	Several questions with this that, ultimately there is the usual Okay. which I didn’t mention before She certainly be rather than the other people that we see Again, it’s kind of, it’s that

	This is where my knowledge I think out of everything, I'd certainly
12	just writing down what her hands are doing. so I'm thinking oh goodness what are…
13	Okay Well… It's going to be That would be the other thing Fair enough.
14	The exotics as I call them Or you could have That's about it, really.
15	Okay Okay, maybe that… How is she—I'll wait till the end. Okay. I'll leave that one. Let's stick with what we've got at the moment. Okay. I'm kind of, at the moment, as I think about it a bit more.
17	Okay. Am ….wow, Right. Wow. Gosh. So…… Okay. Okay. Feedback, it's a click, you hear a click,
18	Okay. Okay. Oh dear Okay. Does she also have…
20	Yes, please.
21	Can she generate And occasional and like the last, shouldn't compare I didn't even think about that for the last guy. The other aspect to that You could have, introduce her to the concept

22	We don’t accept referrals for environment control, unless people are due to be discharged within eight weeks, which she is. But also, the people that work on that caseload and I don’t work on the EEC side I’ve flicked down to see the languages. That’s what made things difficult with her previous caseload. I’m now thinking, I know why I’m a speech therapist and not the OT, because I think, possibly, but I don’t know. Gosh. She’s less intelligible than the previous one. I’m just looking down to see what I’ve missed. Depending on … obviously, yes. Often, I mean, I don’t think I’ve been thinking In an ideal world but it just pops in
23	They are about eight centimetres tall. but that’s like hen’s teeth. So you could have, It doesn’t say … It’s probably it.
24	Okay. oh, lord. Poor lady. Sylvia, you just keep giving me these patients, just when I can’t do very much. This is torture. What are you doing? Torture. Wouldn’t you bloody be. Okay. When I was 36 my PMT was probably at the worst I ever was all the way through. I think I might have taken that. Okay. Yeah. Oh lord. Okay. These poor people. Poor lady. Oh dear. Okay. oh dear, well Wasn’t she just. She wasn’t married to the doctor, the doctor married her. Oh dear, lord It doesn’t matter whether you are a shop assistant or not, it’s just horrible, isn’t it, these things. Okay, right, Okay. Goodness. Wow.

	Poor lady. poor lady Right. Poor lady. It’s actually better than the other client. It just doesn’t sound God help us all. Okay. I know she’s XXX rather than learning in pairs Okay. And something like as much as it grieves me
25	Ok. OK OK OK. see her Can I remember to hear her before I start rabbiting on. (clients voice). Although I hear more words in that one compared to the others OK and obviously she got some Ok erm and erm erm yea say I don’t know at least say at least six
26	Okay, blah blah blah. (Laughs) Okay. Erm, oh erm, Ummm. Erm (0.2) Erm would need to be,
27	Erm, okay, erm… Okay. so she might be able to … and erm, yeah.
28	And in this situation, the decision would be is … She could use… I keep on trying to think of the word, but I can’t think of it.
29	Can’t believe the physio left her like that. Again, I think if she’s—

30	Maybe there is some problem with the records. They are all secondary. Of course they are. That's right. They'd gone out to … In the first part of the video we saw her using the joystick. I've just remembered something about Jordan. He prefers the ETran. Not by choice. Did I write that down wrong? No, he preferred the light writer, didn't he. It was mum that liked the ETran. Was Jordan the first one? Maybe it was Jeff. It was the test one. I think if it was Jeff that was using the ETran. It's just come back to me. I was thinking, I know we are not talking about specific devices. So was it Jeff that was quite happy with the Etran. That was the test one. So she didn't like the ETran, anyway. I think with the other ones I was saying I would have then referred to and gone on and talked to somebody else I think. I could have perhaps have done those with the others as well and have a talk straight away with xxx and with xxx about computers and think about doing some sort of joint visits to see whether we can separate out some of those issues.
31	My first thoughts would be might require an extra. It's not Yes, as far as possible.
32	Going to ask you in a second, because I was thinking, I am wondering and saying what's going through my mind, I'm suddenly feeling I'm losing the thread. I'm just thinking, why didn't I think of that for the previous client, but it's because I'm thinking the word independent at home has made me think of ECS. Whereas it might be just as appropriate for the other client. What was asked for didn't trigger that. She's going to need.
33	as kind of like you know if you've got a lot of abduction going on here and if that's not responding to mobilisation and that's going to be probably influencing what's happening generally throughout and it's kind of like the referring for XXX
34	which is what we did with the other one. Great. so that's in terms of her background.

	Okay. Okay. Okay. Right Okay. Okay. Right. It might (LAUGHS).
35	Is it okay to just read aloud as I'm going? Okay. Right. sorry, but, you know, I tended to generalise in saying that Yes. Very short. There maybe …
37	Okay. Okay, oh gosh Okay. I'm thinking about all the questions that I didn't ask about controlling the wheelchair with the first guy. Okay. I think I'm just getting her muddled up with the others. (laughs) I can't remember
38	Okay Okay. She also has a mild Aphasia. Okay. You don't want me whispering. Okay. Are you going to put it on? Okay. I will flick between all three and think aloud without probably stopping. I can't see But and that… Is that enough?
39	Okay Okay. Okay. Poor woman. Okay. Okay. Gosh, right, okay. That's something I would want to look at. What did it say here? Am I allowed to ask?

40	Oh gosh Okay Okay. (0.4) I want to watch it because that's a .. You know what I'm going to do now, don't you. Okay. Okay. and you're going to tell me to think out loud. Yeah, thinking aloud. Right, okay, We saw a chap who has got two switch and scanner choosing easy keys and he's a fantastic communicator. But everybody that works for him just says, it's too slow. That's as fast as he's going to be, really They see his communication as slow through technology. I hope that doesn't sound too negative. Okay. Again, I would … Okay. Does that cover it? A boy I work with has got a device that will do environmental control, but he has got separate environmental controls and kept those two separate and that seems to work well for him.
41	Okay. Okay. Okay. . Okay. All right. Okay Okay. Okay. Erm, okay
42	Ok. Oh, I'll read through this. So, she's, Ok, so Ok, so again
43	Oh my goodness. Just not sure about that. I'm sure there would something XXX potentially in her hands.

	about so that they've been referred to before, but probably not in our experience I really do like the Asian voice. Natural sounding voice if she did want it. It's really nice. It's just a thought I would be wanting to ask a lot of questions She could XXX
44	For me, at the moment I think I would probably be— I would probably
45	I've got a second name. Same issue. Okay.
46	and almost thinking that she's got— Right. I think also the potential that I would think of a I would think because she's
47	we haven't got there yet. Mm huh A lot of this stuff and decision making tends to be by looking at the person and what they can do in a happy sort of relaxed position and actually reading about it is quite a difficult thing isn't it? More used to looking at people and how they are sat. with fitting that. Although, we have the Wheelchair Service
48	Right Right Right A dynabox or a dynavox type system, which I can't think of at the moment There is quite a few around now, would suffice. Thinking aloud I was speaking to him on Monday. I can't remember his name. He was one of the, he chaired one of the sessions, xxxx. Have you met Putting my thoughts together. which the name escapes me for the clip to go

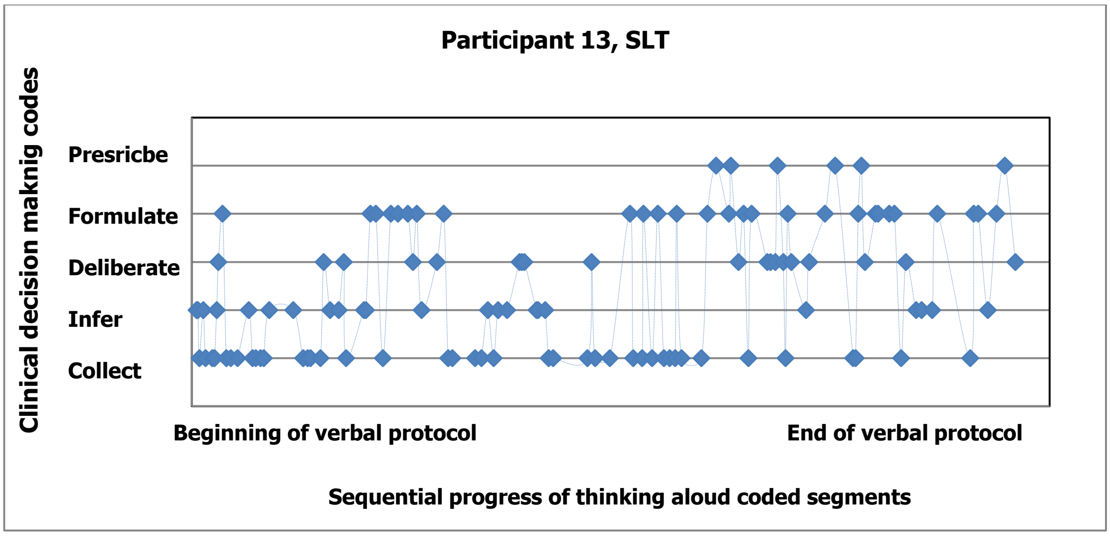
49	An open mind. Right, okay. I just couldn’t even guess. Right.
50	Okay Okay. Great I read things out to myself a lot. One thing that isn’t actually mentioned on there is whether I apologise for not speaking it out. So, I would, like I said, I would be trying, I just had something in my head then that I was going to say relating to this and it’s totally gone.
51	That’s a handful That’s about my wife’s size, I think. I understand that one. Some of the names I recognise as medication, but some I don’t. Right. Okay. So a lot of—what was the first one, again? Okay. So I’m thinking about that and I would think well, Okay. Right. Right. Right Okay. Right. Okay Right. I think that’s probably where I’d go.
53	Okay. Okay. She would. No offence.
54	Okay Right Somebody needs to look at that, don’t they (laughs). That’s not really getting us towards the device. I’m probably showing my bias to suggest that if she’s going to go online—don’t know... Okay. Do you need a firmer—

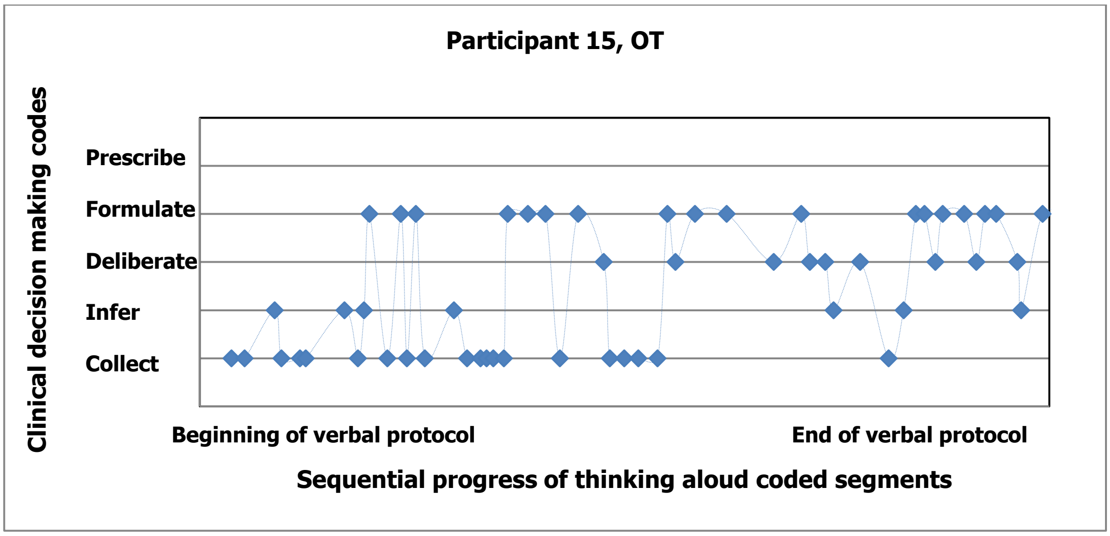
55	Let’s have a look at the video and see what I can make of this. Reviewing the video from the start again. I’m just reading the communication section on the case scenario, again. Just having a quick look through it although I’ve not seen her do this. I think that’s about as far as I can take that.
56	I’m forgetting I can ask you. Hopefully, that’s useful.
57	Okay. Okay. able to say a few single upper And again, just
58	gosh. if we don’t see something about those. Might be when it’s static and it’s being transferred in and out of. Someone might clatter it and break it and damage it.
59	That would be my first comment. We’ll have a read of this Okay Do I get that a bit further down. Okay. would be my initial comment. We’ve got a wheelchair again Is she able to actually operate the wheelchair? Is she naturally right handed? Our first case was obviously going to be intolerant to that I’m obviously not reading the same magazines. Stick War and Peace in front of her or a legal document.
60	We don’t really get involved in those, Probably, but not that I can think of off the top of my head now.
61	Thank you Here she goes Back to task. Start off with the one I know more about (LAUGHS) Okay, Okay. Wow.

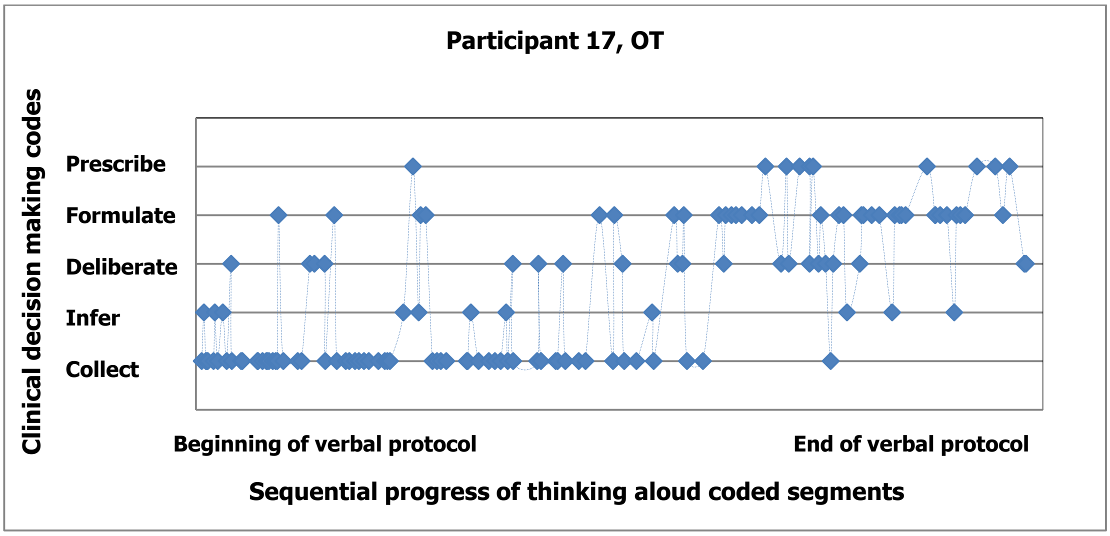
[redacted]	like the sheet says

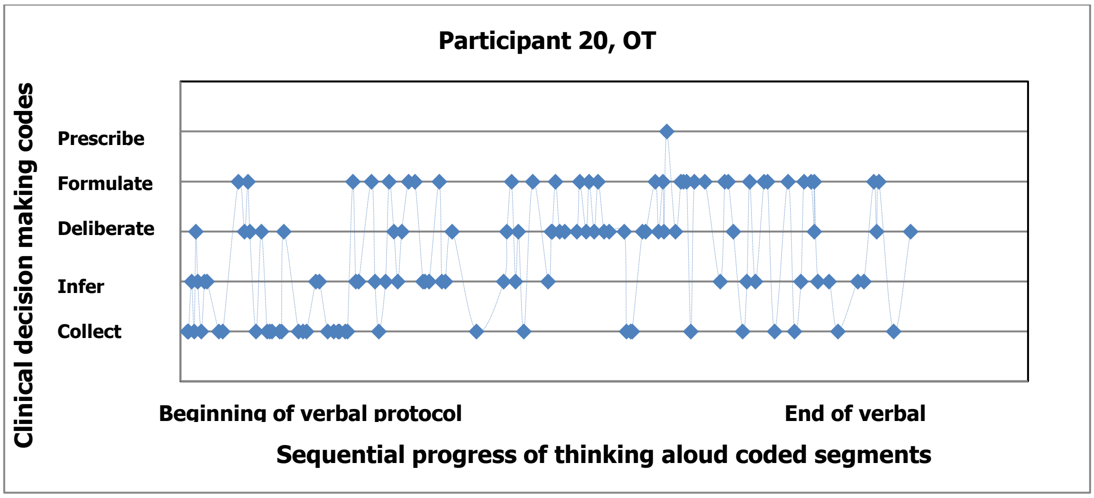
APPENDIX 13

Decision Process Graphs for Capable Level of Expertise









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Clinical decision making codes
Prescribe
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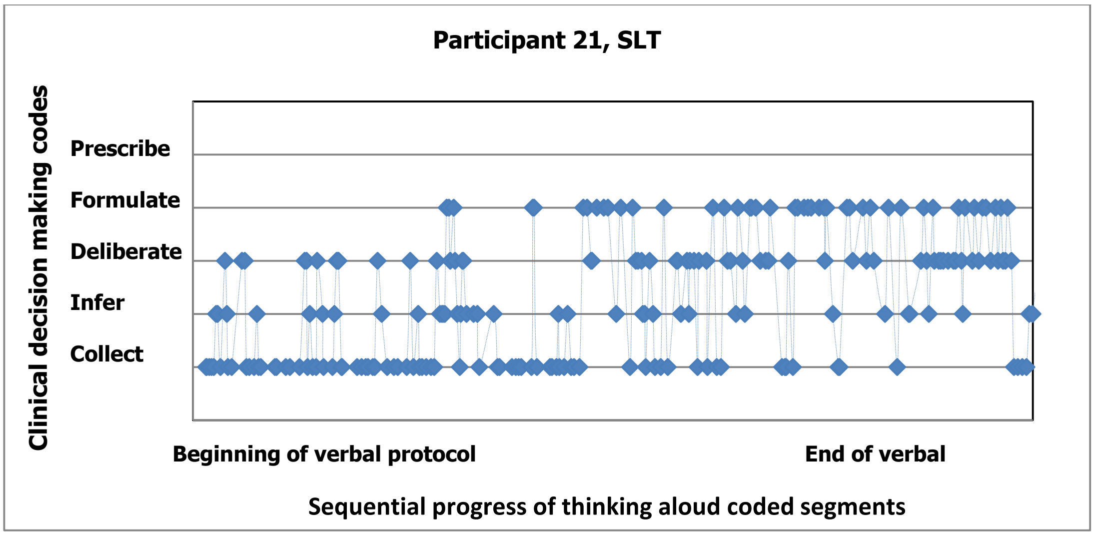
Infer
Collect
Beginning of verbal protocol
End of verbal
Sequential progress of thinking aloud coded segments



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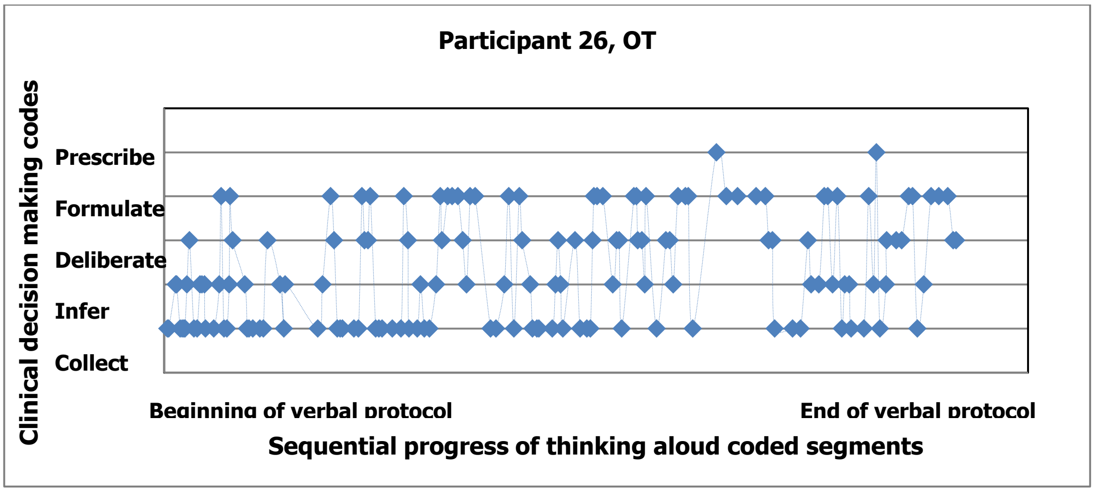
End of verbal
Sequential progress of thinking aloud coded segments



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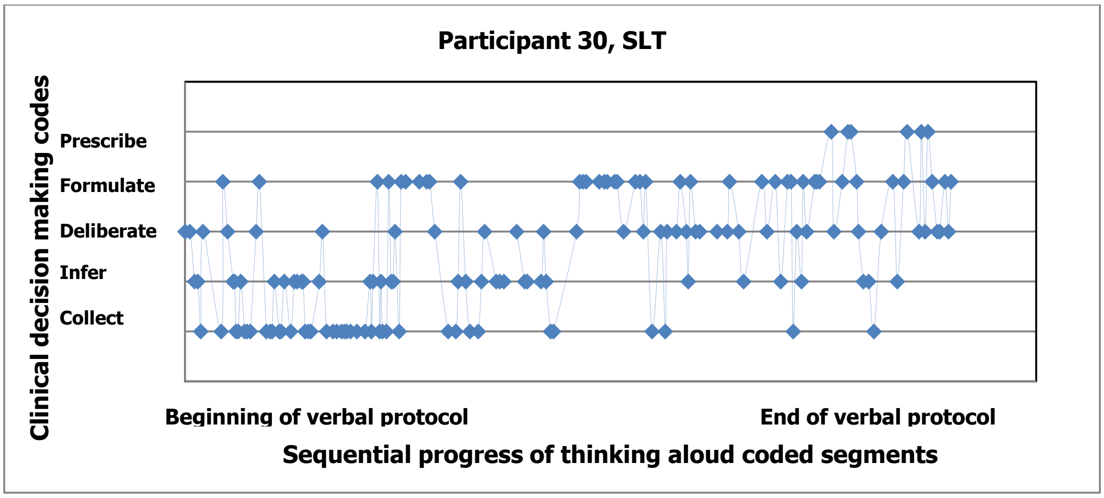
End of verbal protocol
Sequential progress of thinking aloud coded segments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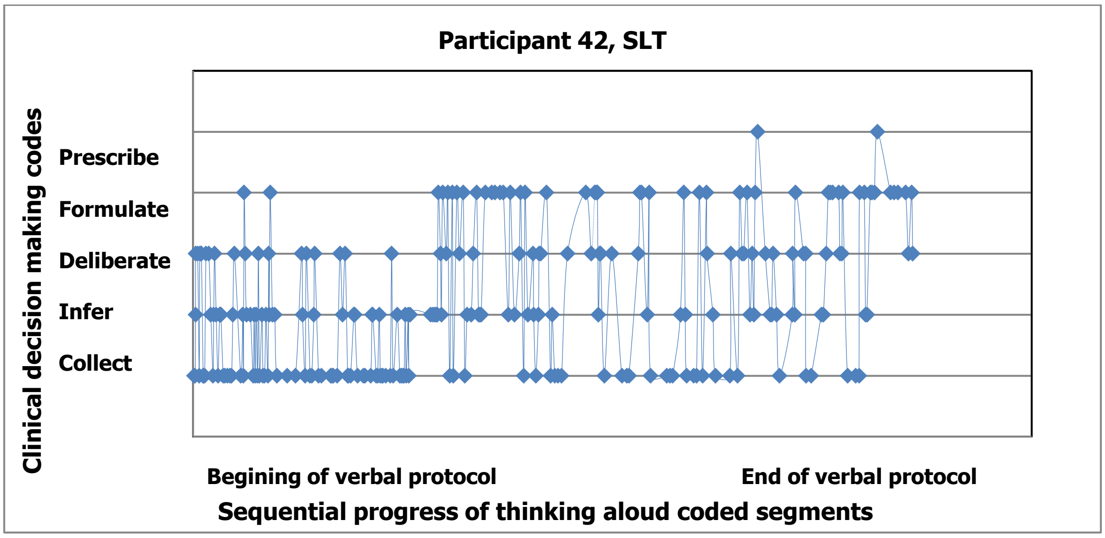
Collect
Beginning of verbal protocol
End of verbal protocol
Sequential progress of thinking aloud coded segments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Collect
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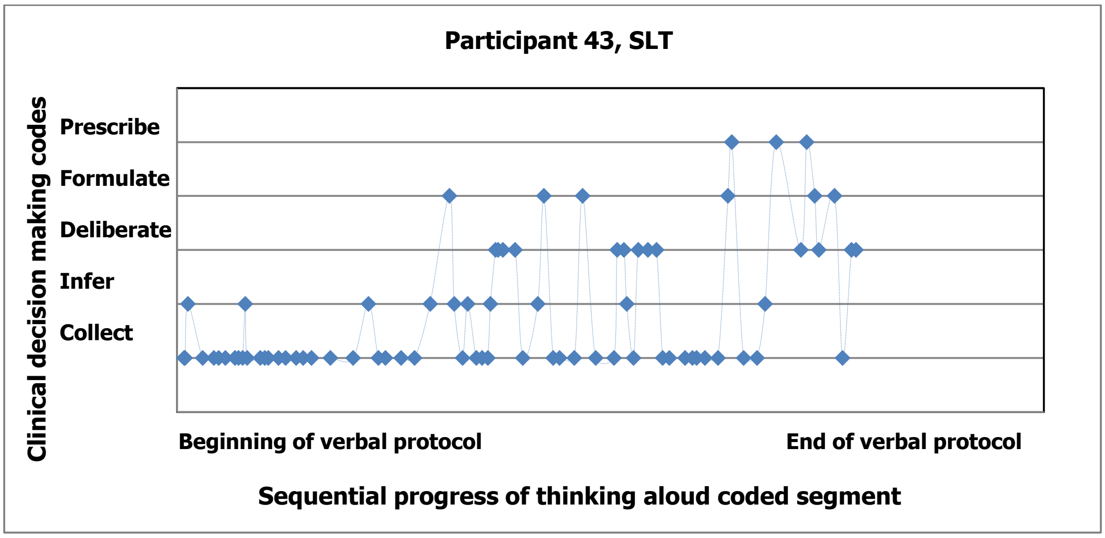
End of verbal protocol
Sequential progress of thinking aloud coded segments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Infer
Collect
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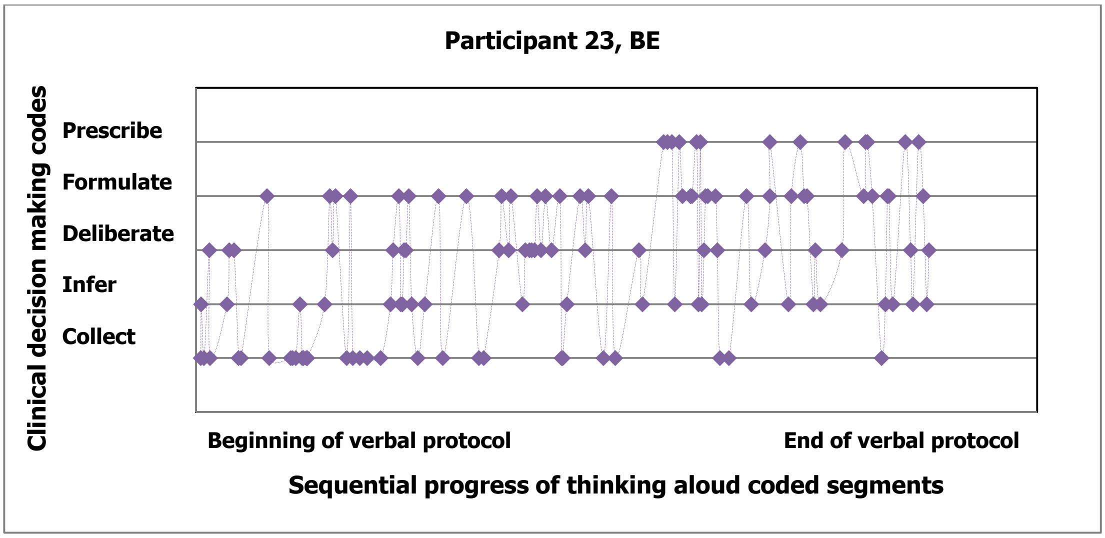
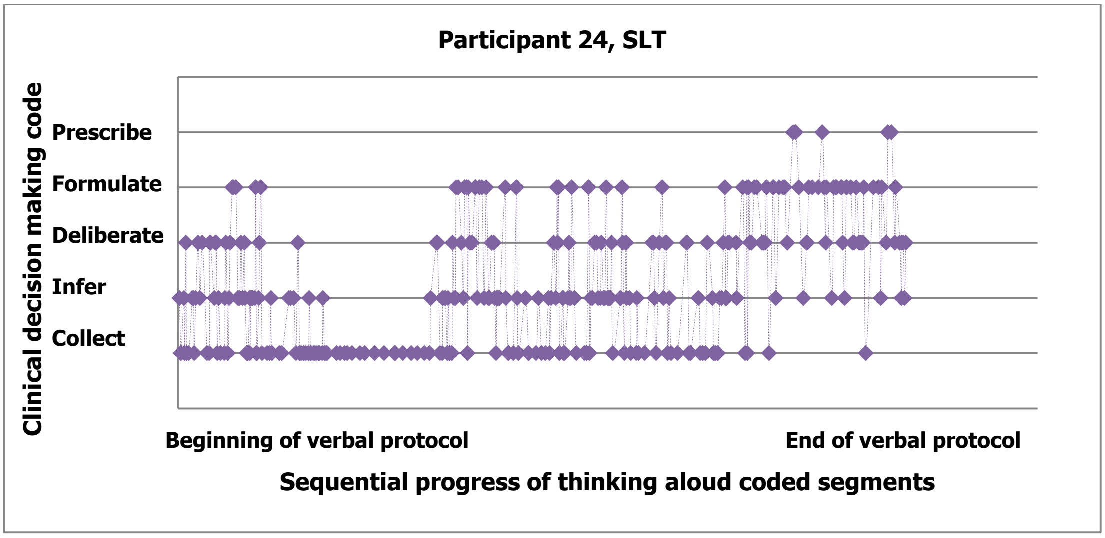
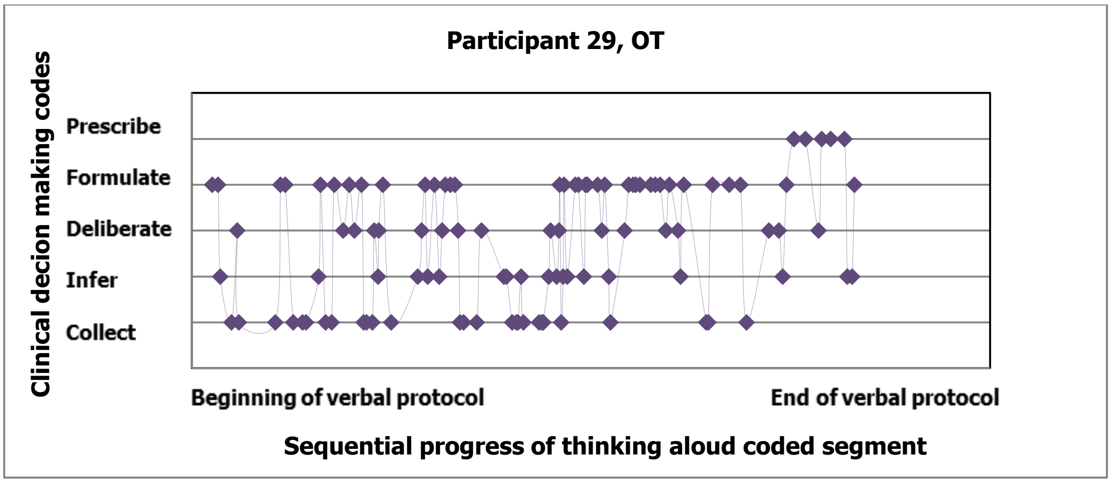
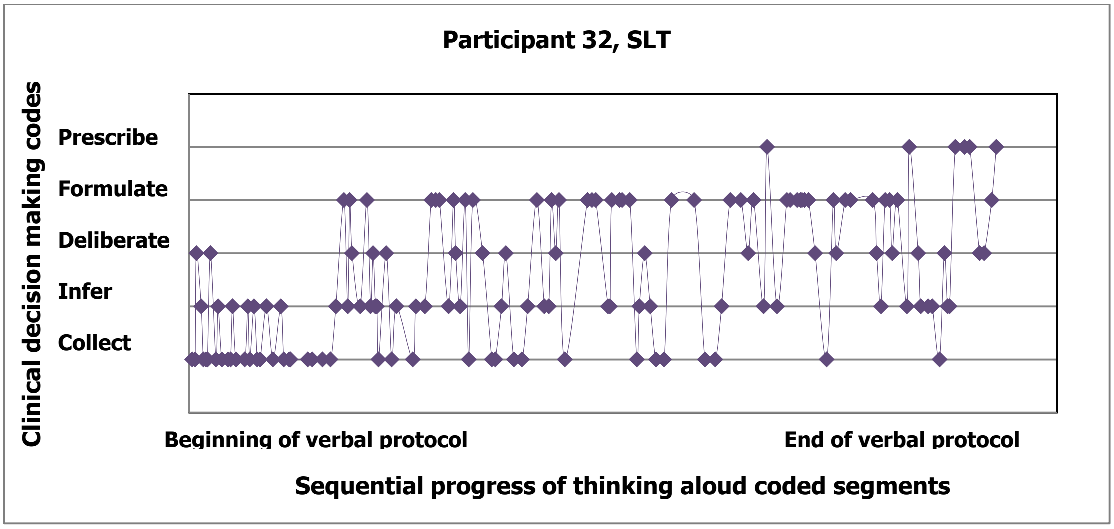
End of verbal protocol
Sequential progress of thinking aloud coded segment

Decision Process Graphs for Skilled Level of Expertise





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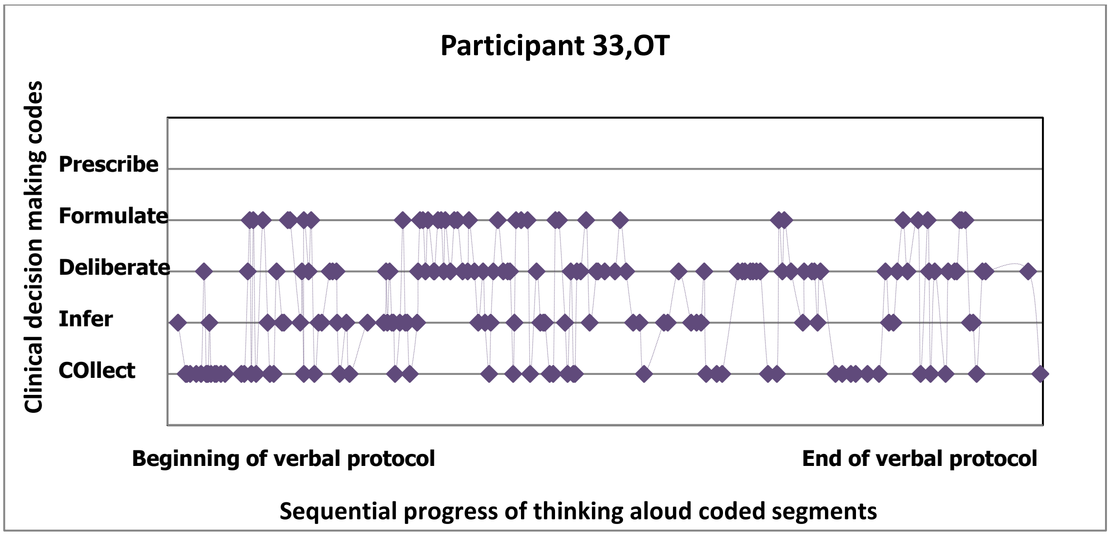
End of verbal protocol
Sequential progress of thinking aloud coded segments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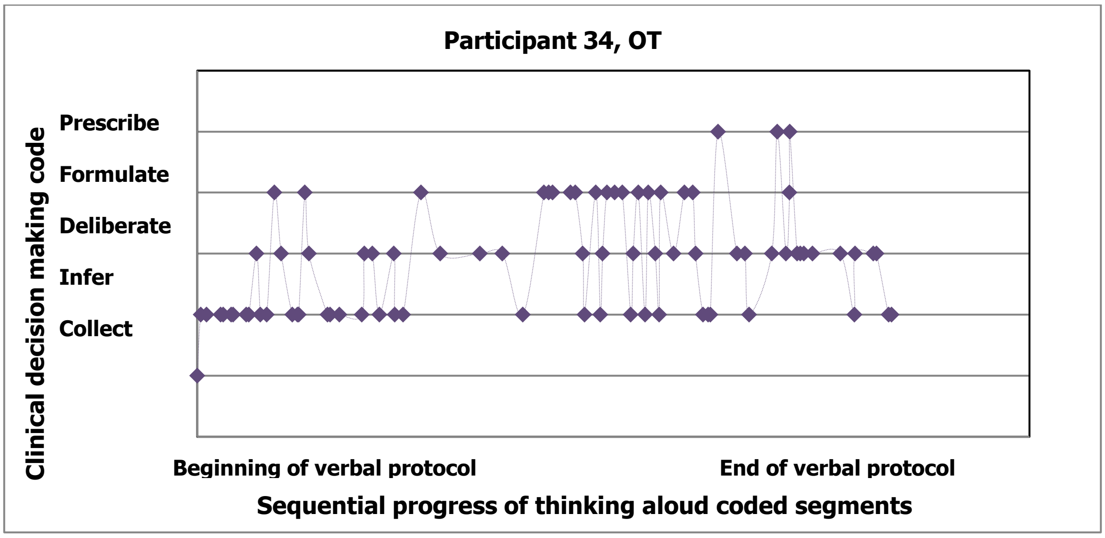
End of verbal protocol
Sequential progress of thinking aloud coded segments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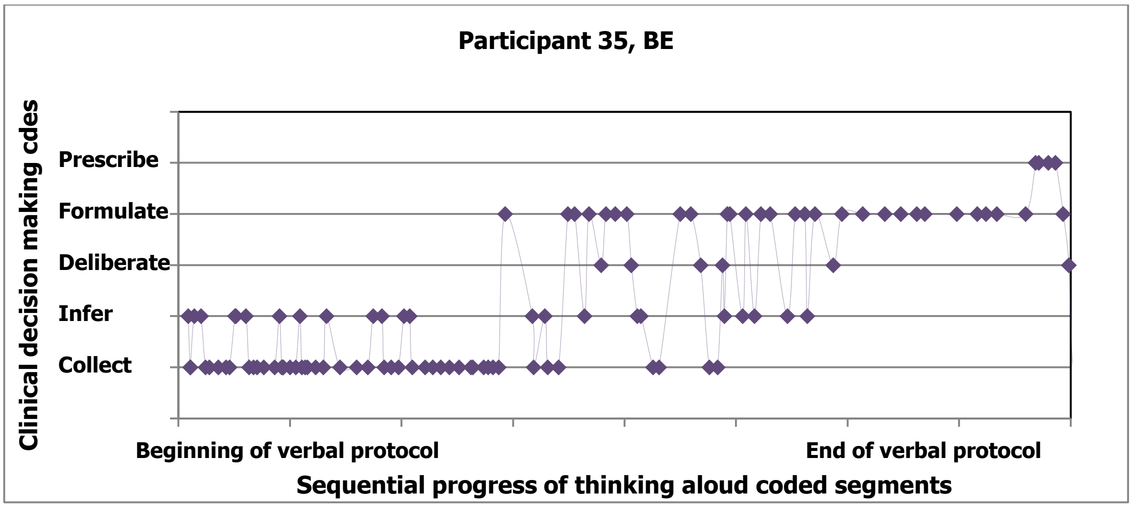
End of verbal protocol
Sequential progress of thinking aloud coded segments



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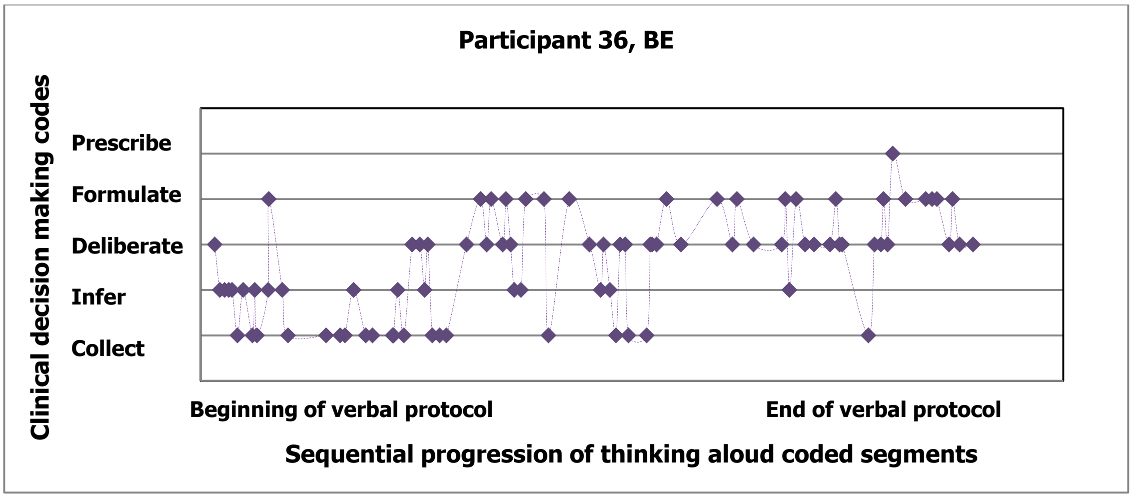
Beginning of verbal protocol
End of verbal protocol
Sequential progress of thinking aloud coded segments



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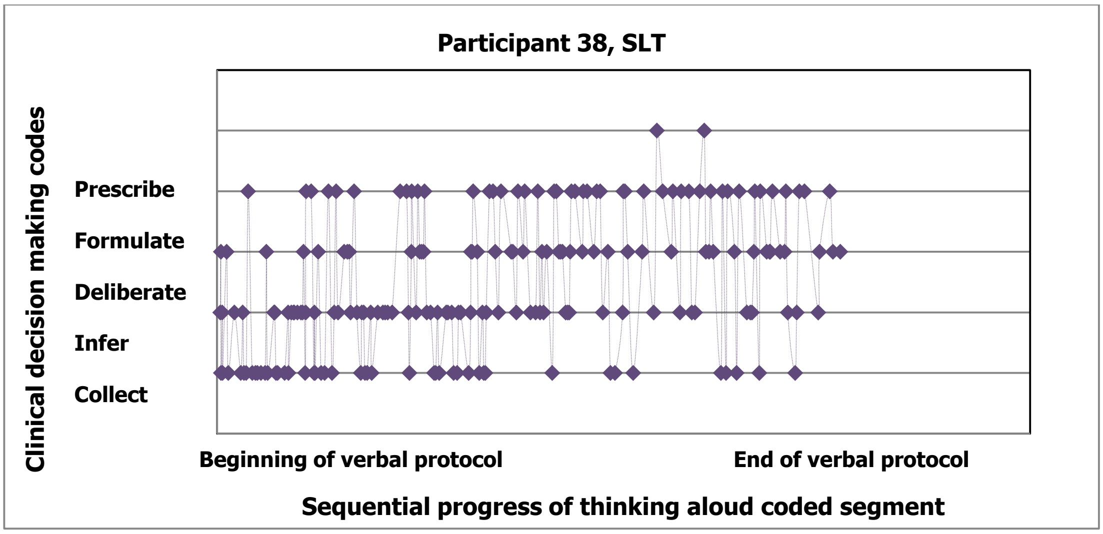
End of verbal protocol
Sequential progression of thinking aloud coded segments



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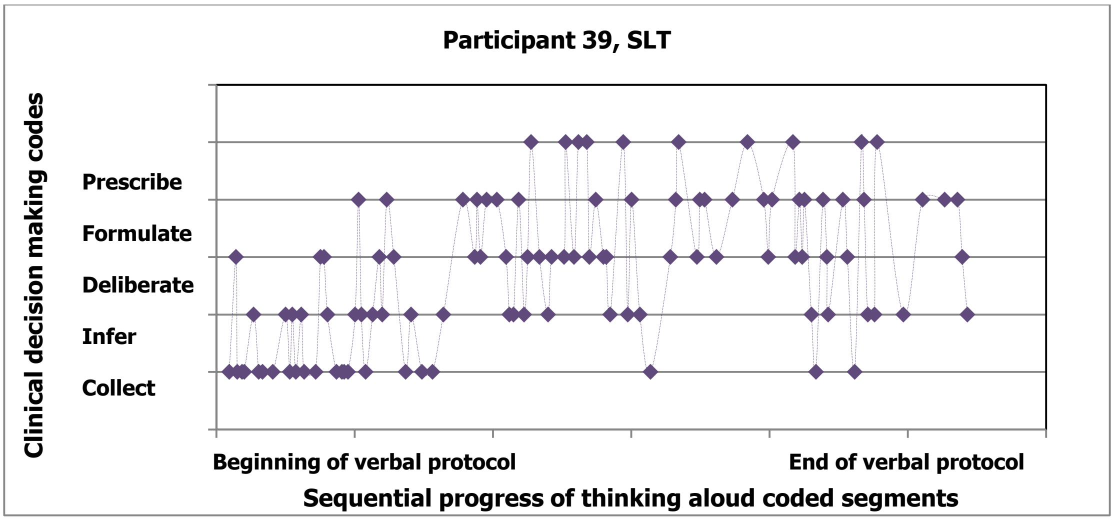
End of verbal protocol
Sequential progress of thinking aloud coded segment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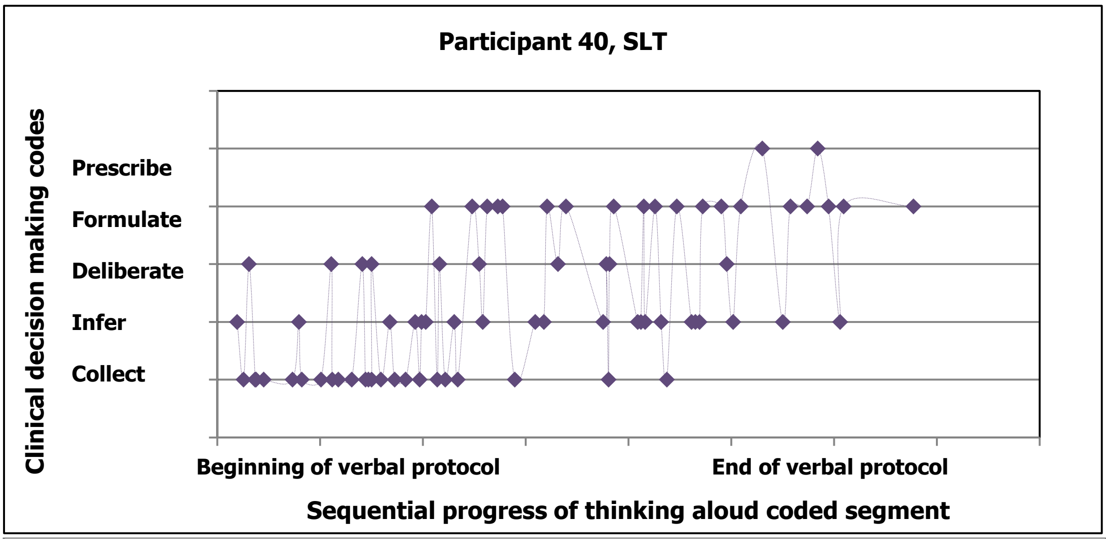
Collect
Beginning of verbal protocol
End of verbal protocol
Sequential progress of thinking aloud coded segments



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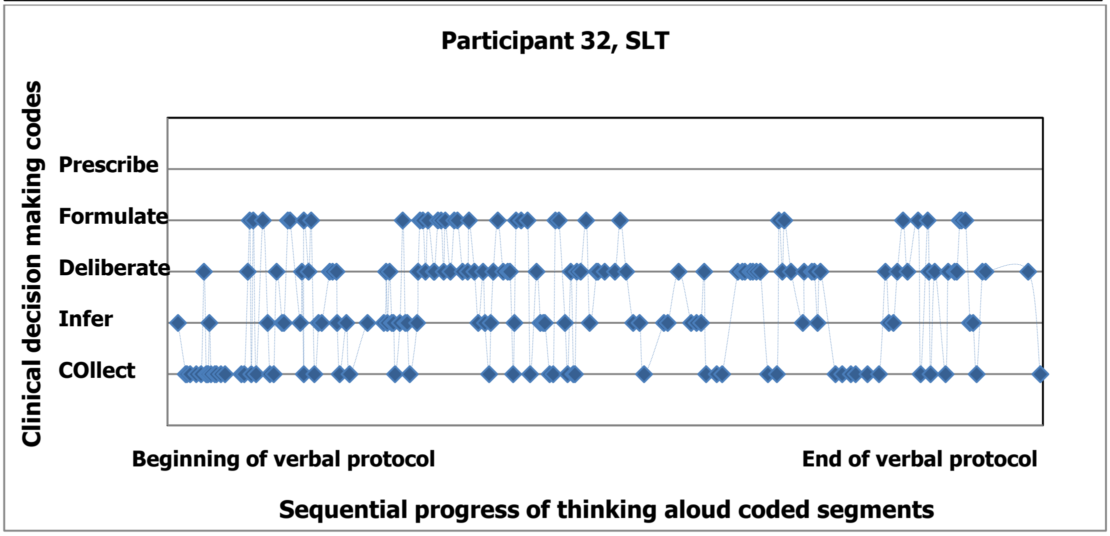
End of verbal protocol
Sequential progress of thinking aloud coded segment



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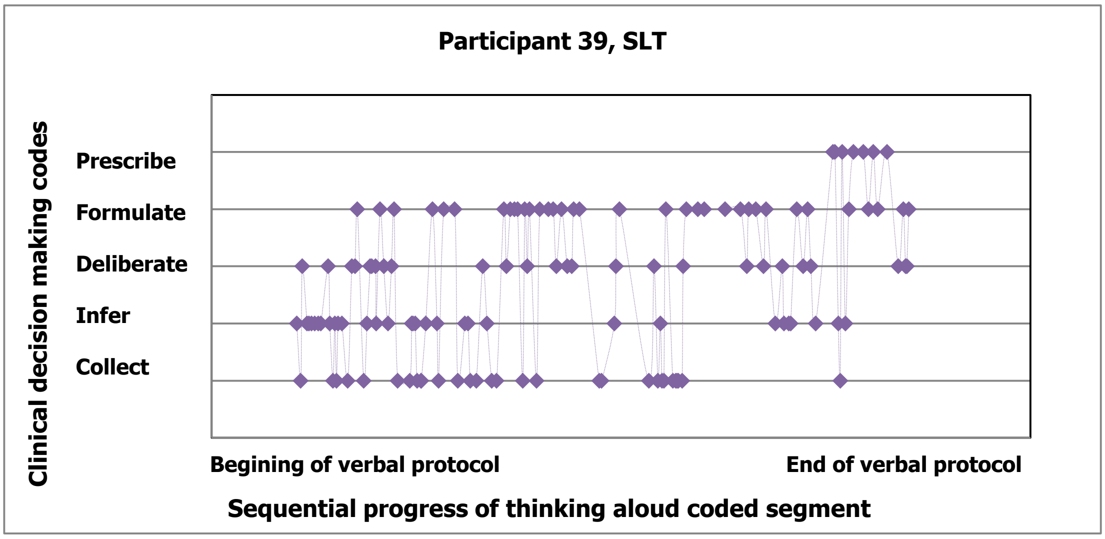
Beginning of verbal protocol
End of verbal protocol
Sequential progress of thinking aloud coded segments



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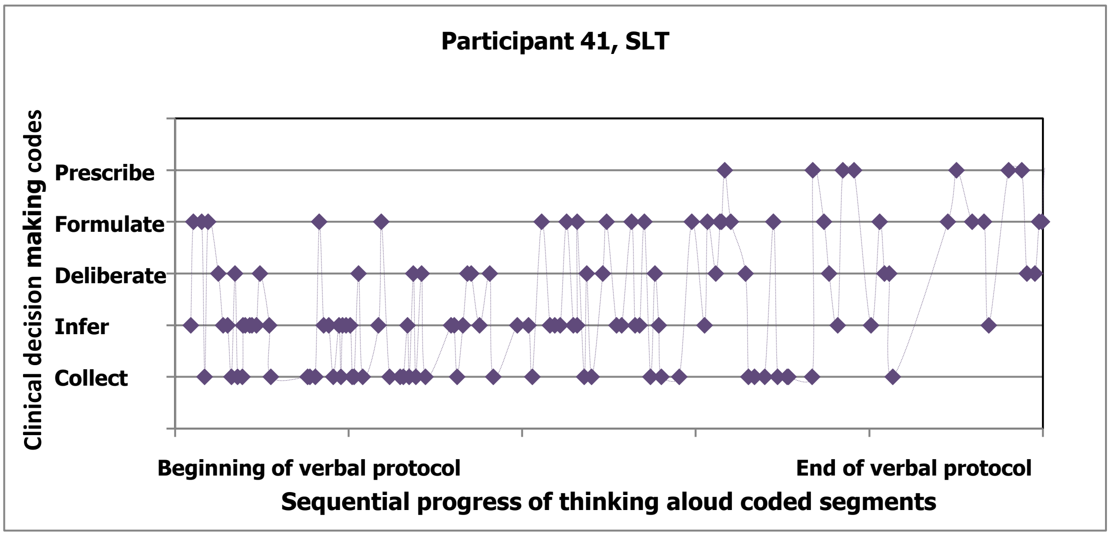
Collect
Begining of verbal protocol
End of verbal protocol
Sequential progress of thinking aloud coded segment



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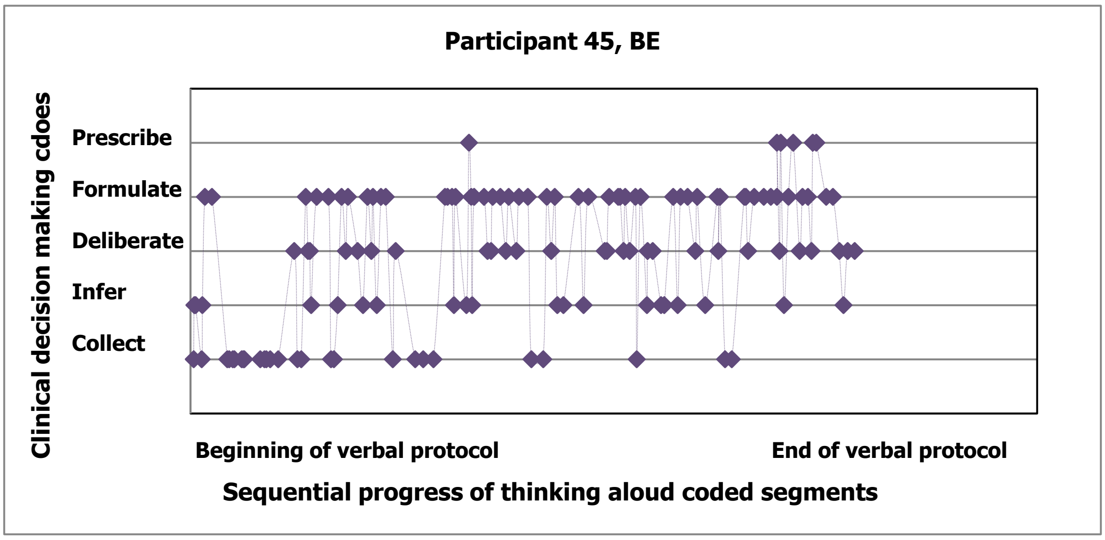
Sequential progress of thinking aloud coded segments



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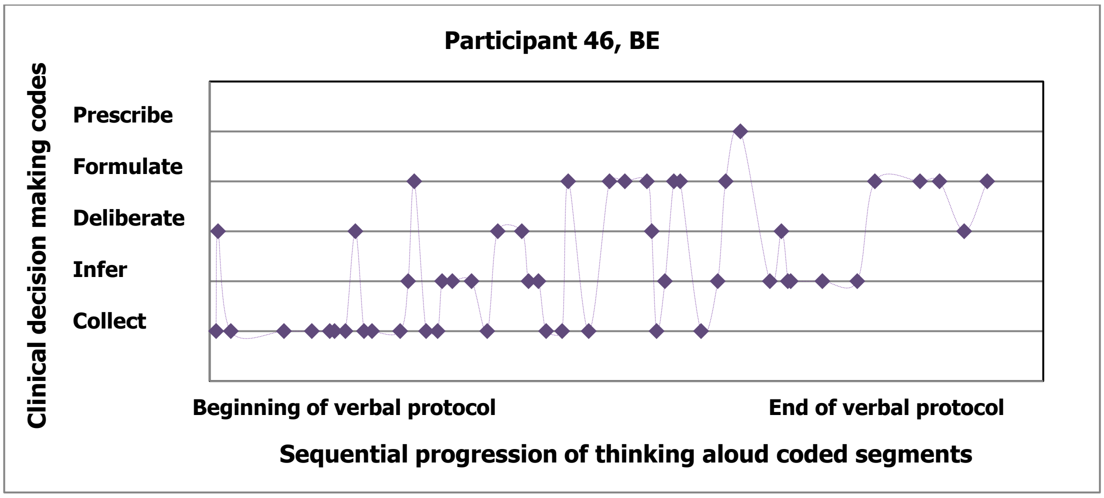
End of verbal protocol
Sequential progress of thinking aloud coded segments



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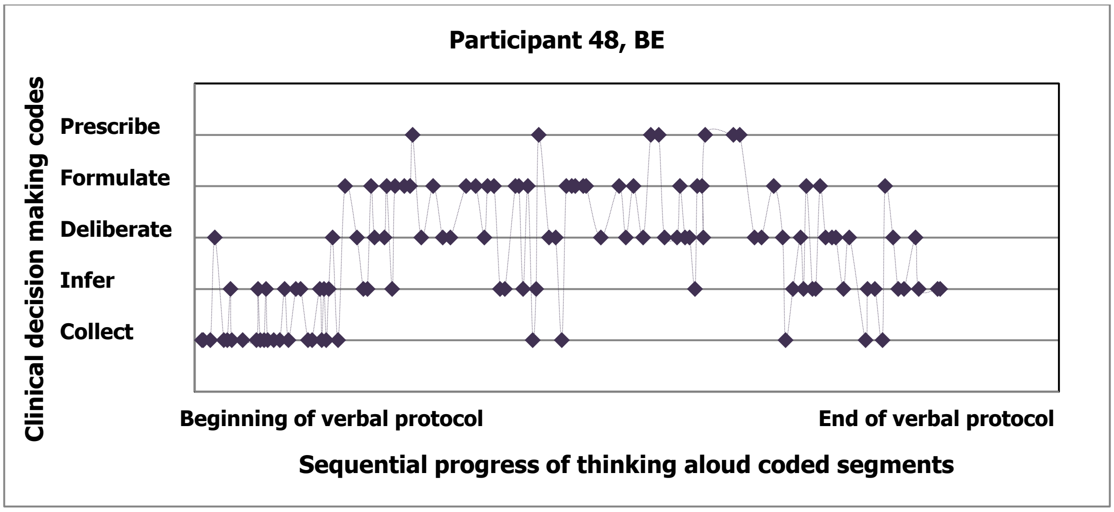
End of verbal protocol
Sequential progression of thinking aloud coded segments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Infer
Collect
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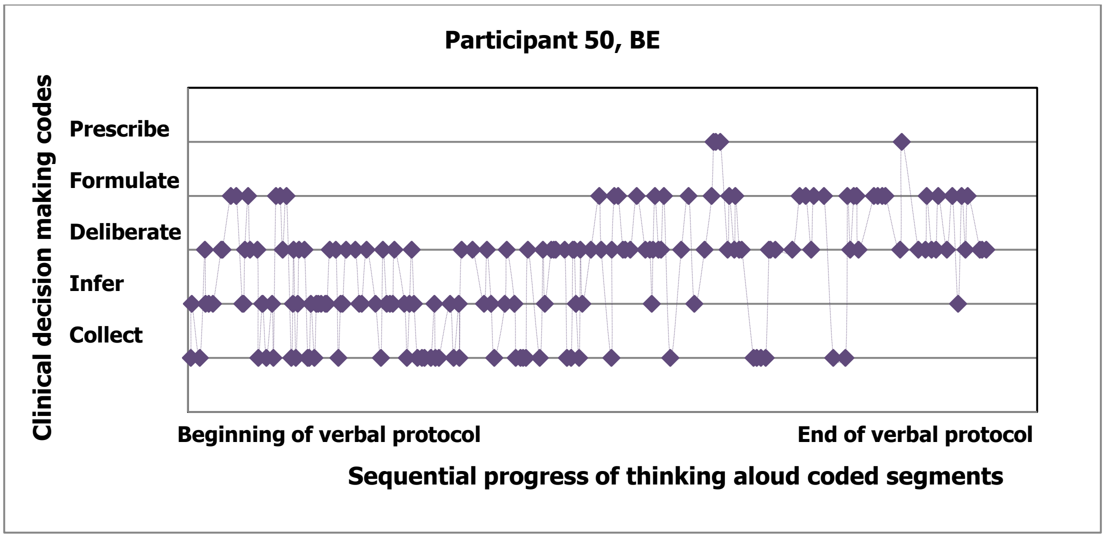
End of verbal protocol
Sequential progress of thinking aloud coded segments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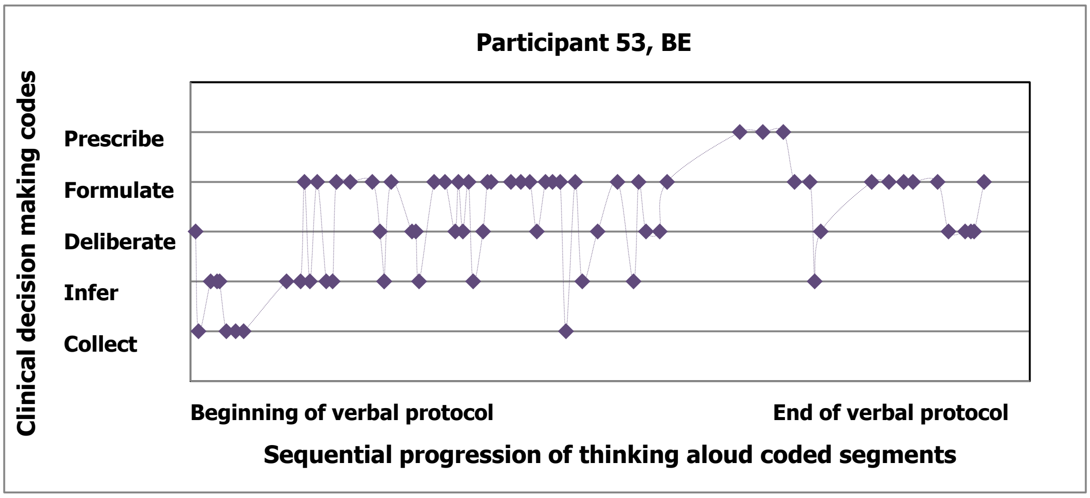
End of verbal protocol
Sequential progress of thinking aloud coded segments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End of verbal protocol
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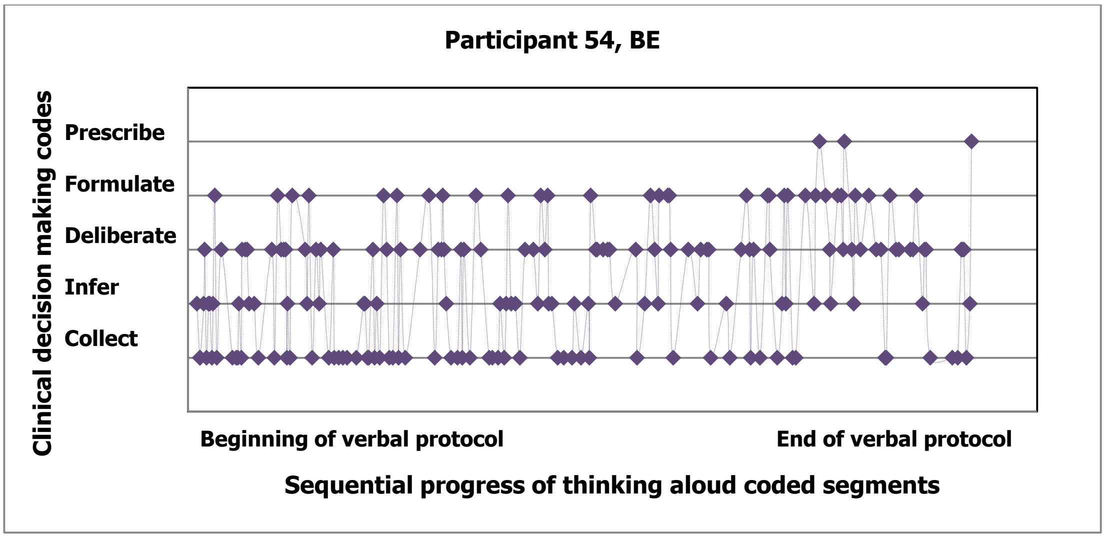
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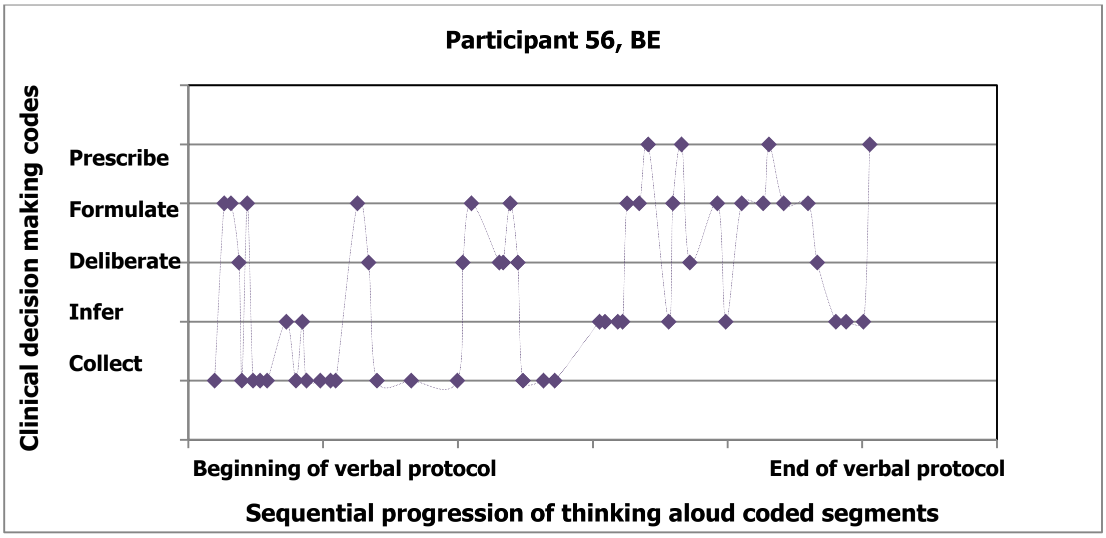
End of verbal protocol
Sequential progress of thinking aloud coded segments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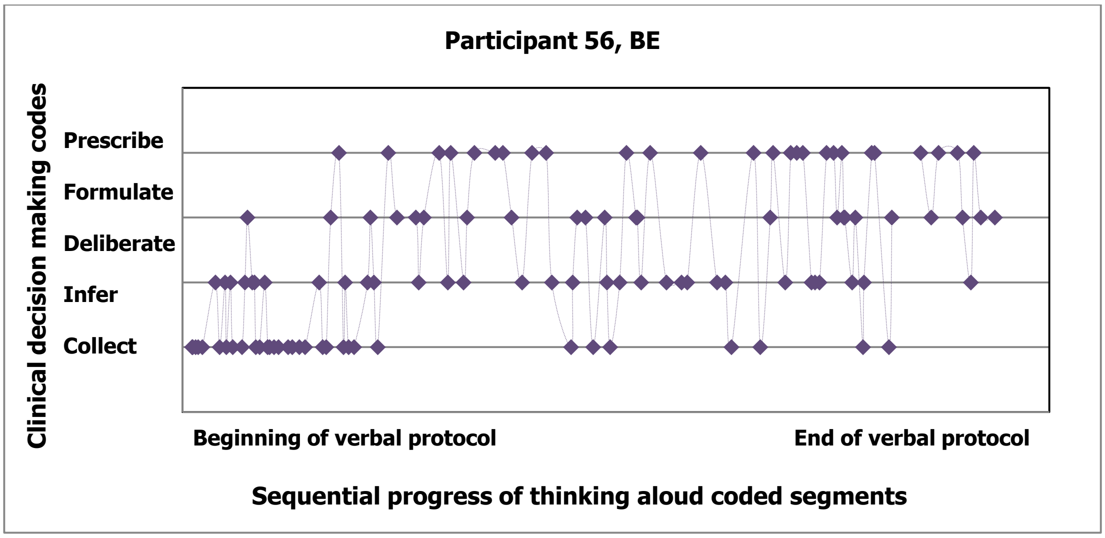
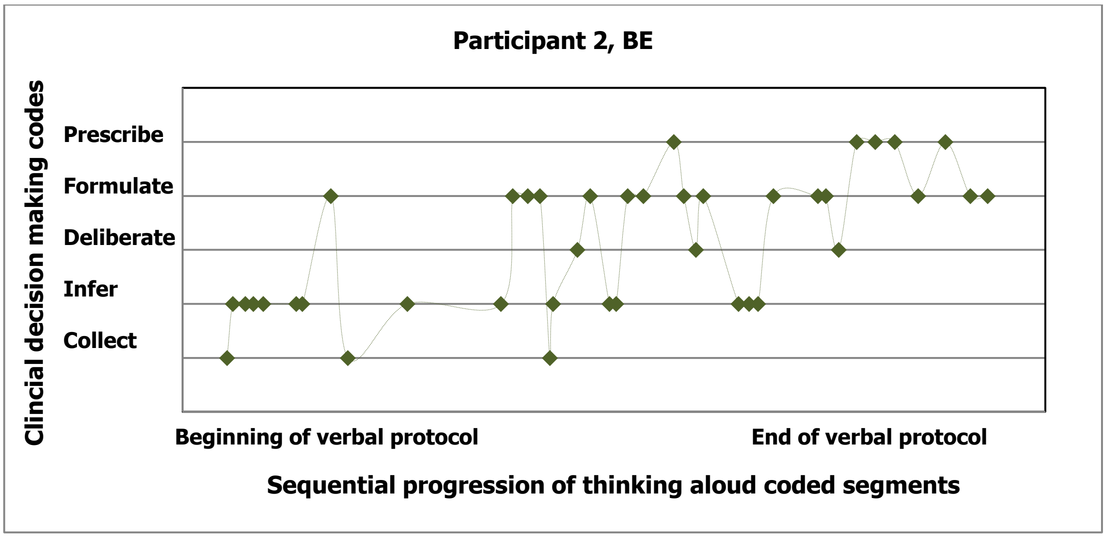
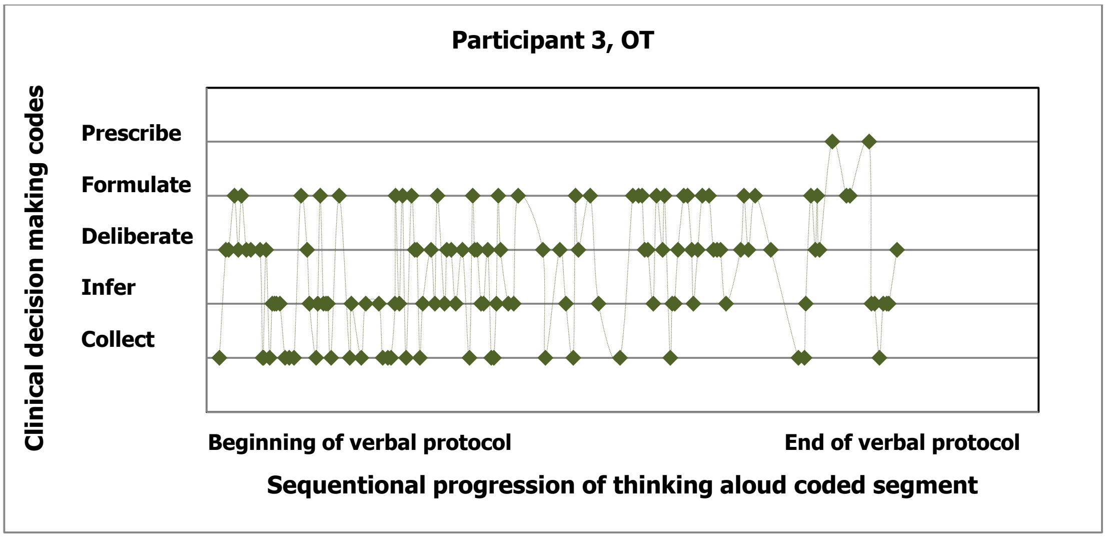
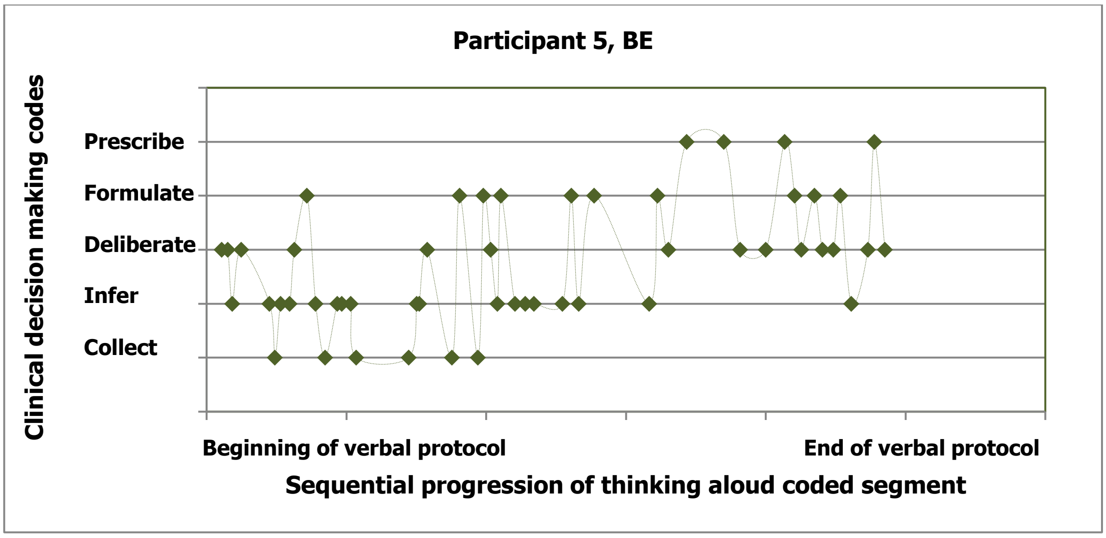
End of verbal protocol
Sequential progression of thinking aloud coded segments

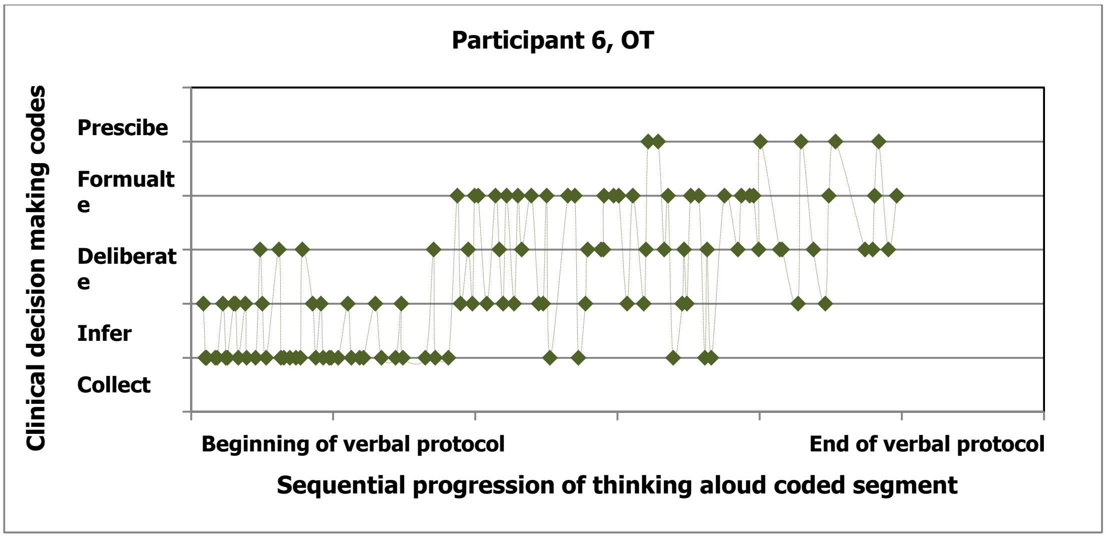

Participant 56, BE
Clinical decision making codes
Prescribe
Formulate
Deliberate
Infer
Collect
Beginning of verbal protocol
End of verbal protocol
Sequential progress of thinking aloud coded segments

Decision Process Graphs for Accomplished Level of Expertise








Participant 6, OT
Clinical decision making codes
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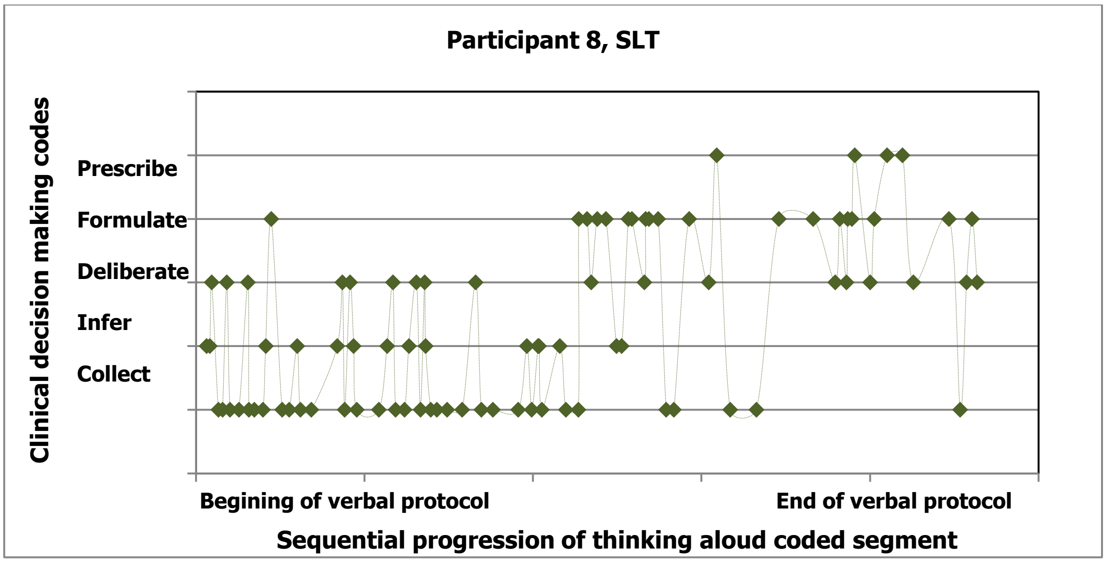
Collect
Beginning of verbal protocol
End of verbal protocol
Sequential progression of thinking aloud coded segment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Formulate
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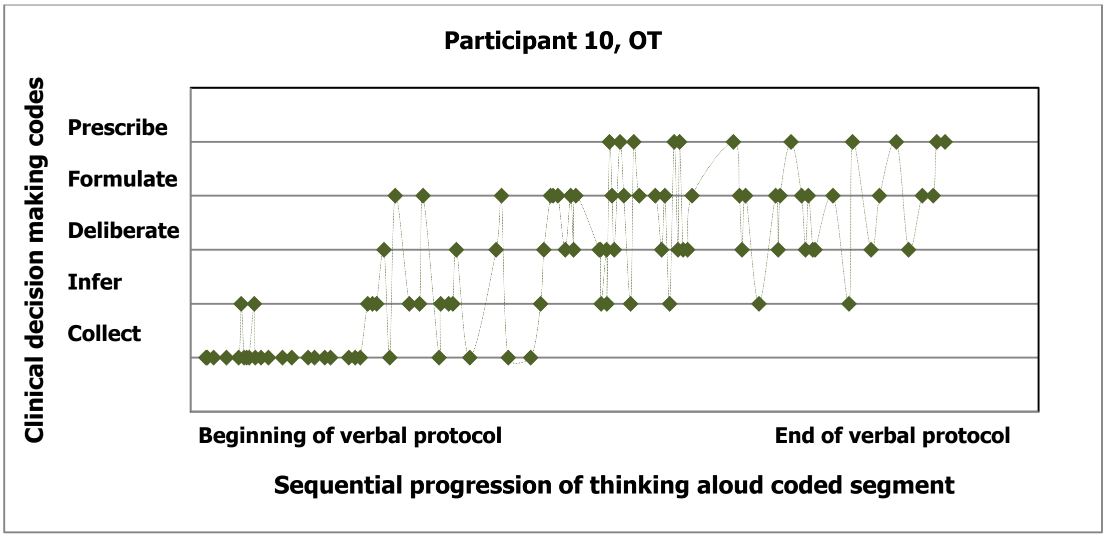
Begining of verbal protocol
End of verbal protocol
Sequential progression of thinking aloud coded segment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Clinical decision making codes
Prescribe
Formulate
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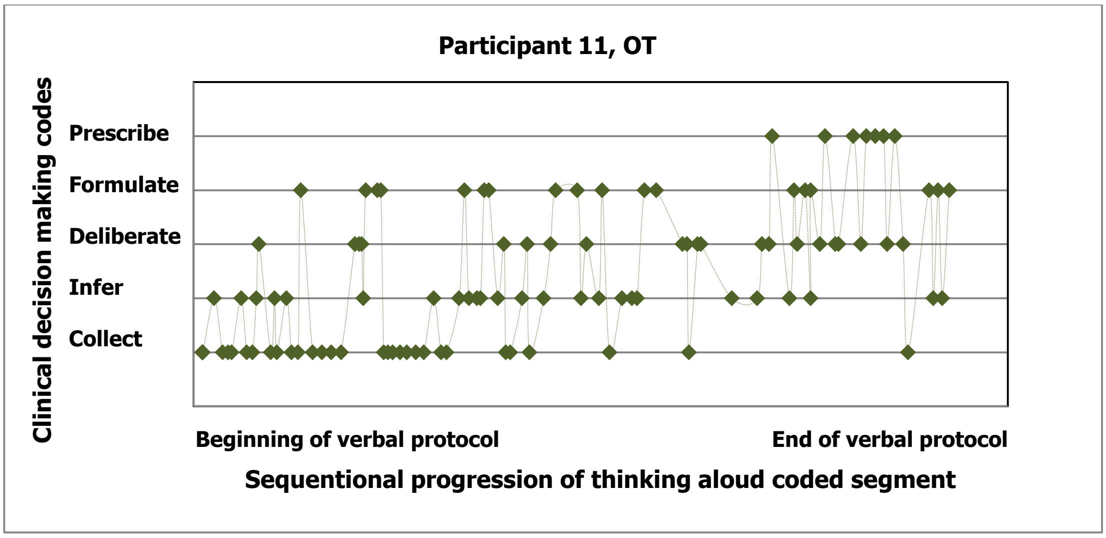
Beginning of verbal protocol
End of verbal protocol
Sequential progression of thinking aloud coded segment


Participant 11, OT
Clinical decision making codes
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Formulate
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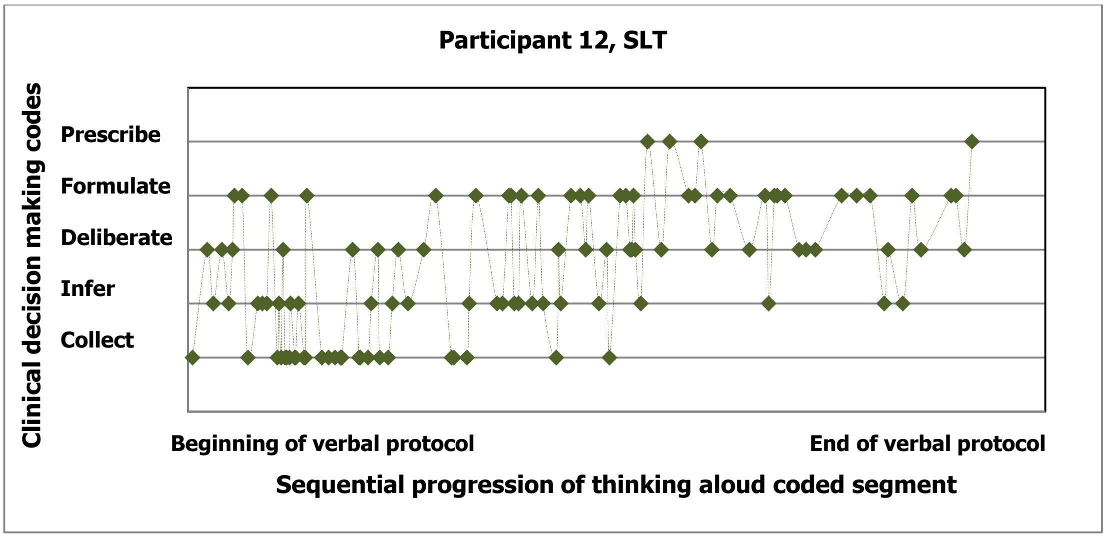
Collect
Beginning of verbal protocol
End of verbal protocol
Sequentional progression of thinking aloud coded segment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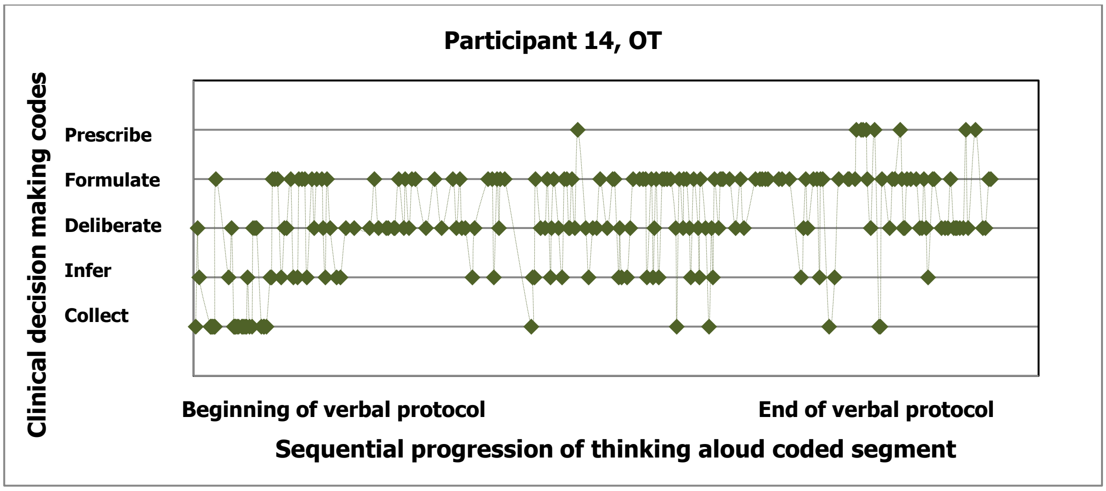
Clinical decision making codes
Prescribe
Formulate
Deliberate
Infer
Collect
Beginning of verbal protocol
End of verbal protocol
Sequential progression of thinking aloud coded segment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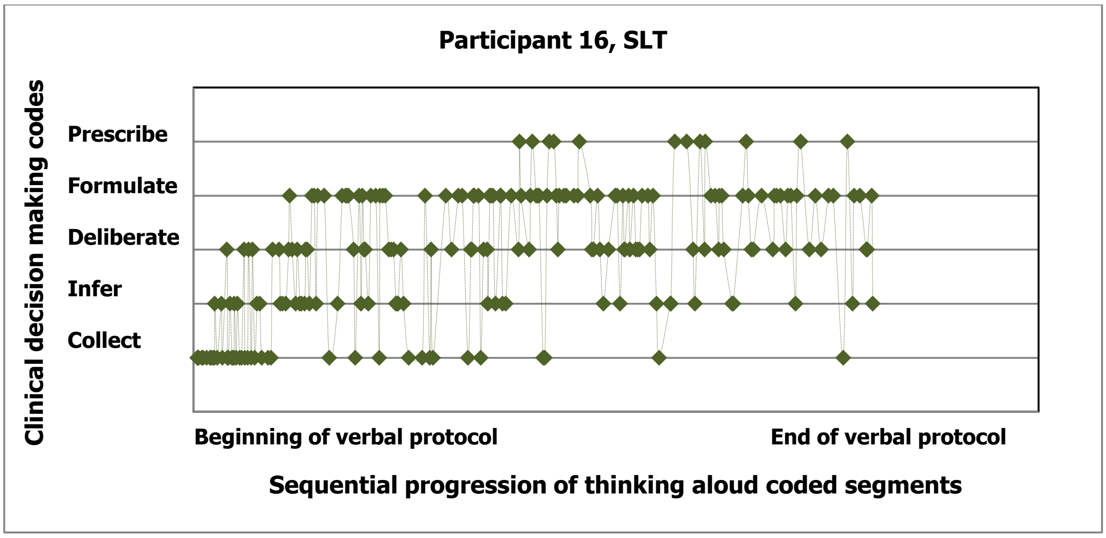
Clinical decision making codes
Prescribe
Formulate
Deliberate
Infer
Collect
Beginning of verbal protocol
End of verbal protocol
Sequential progression of thinking aloud coded segment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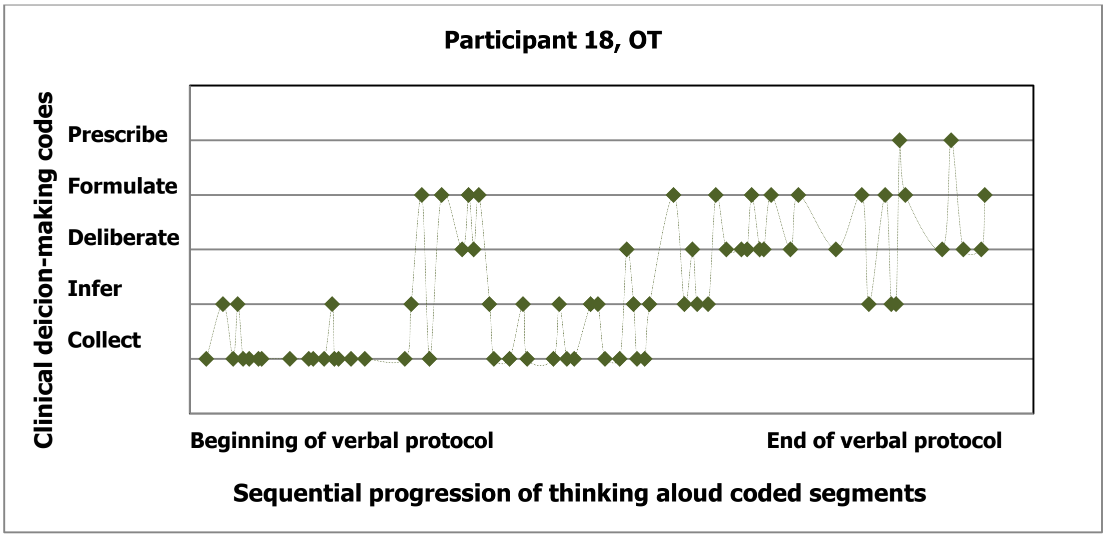
Formulate
Deliberate
Infer
Collect
Beginning of verbal protocol
End of verbal protocol
Sequential progression of thinking aloud coded segments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Prescribe
Formulate
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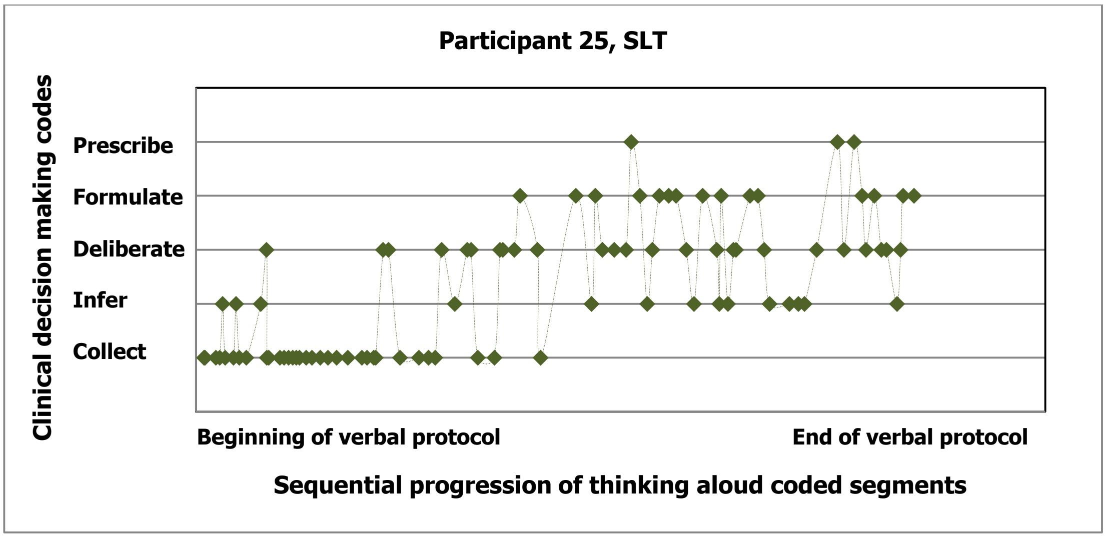
Beginning of verbal protocol
End of verbal protocol
Sequential progression of thinking aloud coded segments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Clinical decision making codes
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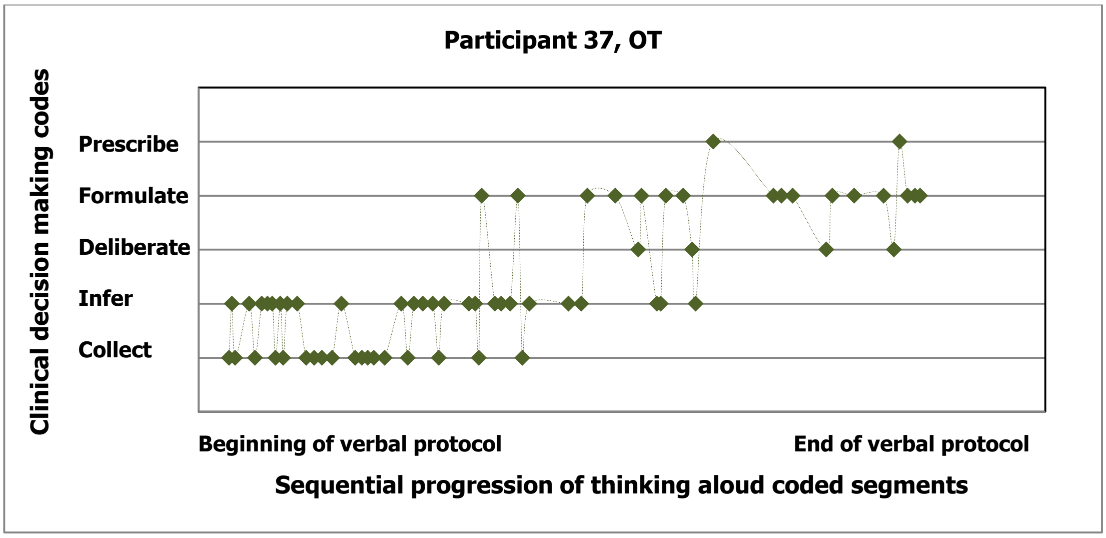
Formulate
Deliberate
Infer
Collect
Beginning of verbal protocol
End of verbal protocol
Sequential progression of thinking aloud coded segments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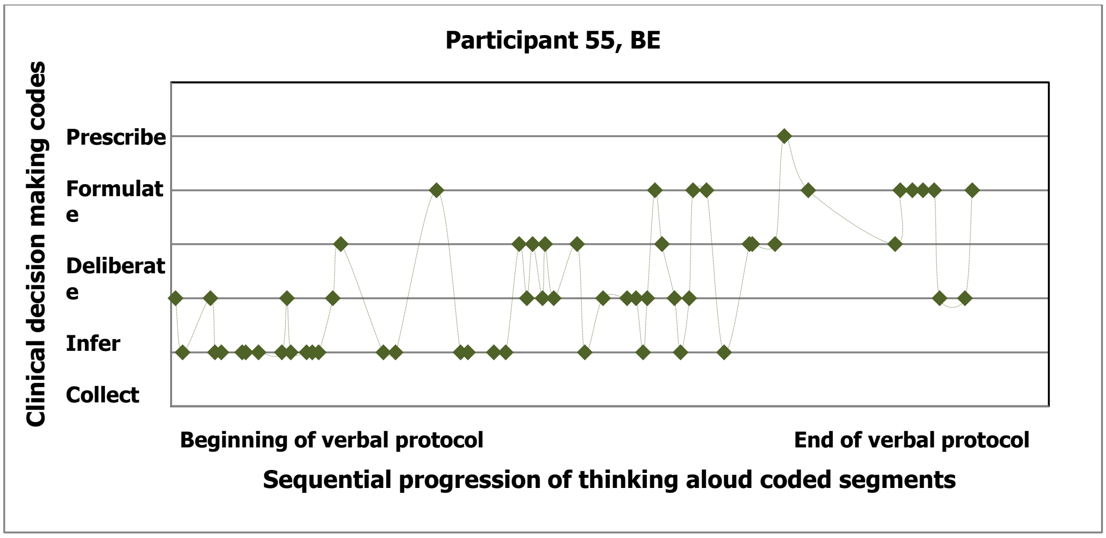
Prescribe
Formulate
Deliberate
Infer
Collect
Beginning of verbal protocol
End of verbal protocol
Sequential progression of thinking aloud coded segments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Clinical decision making codes
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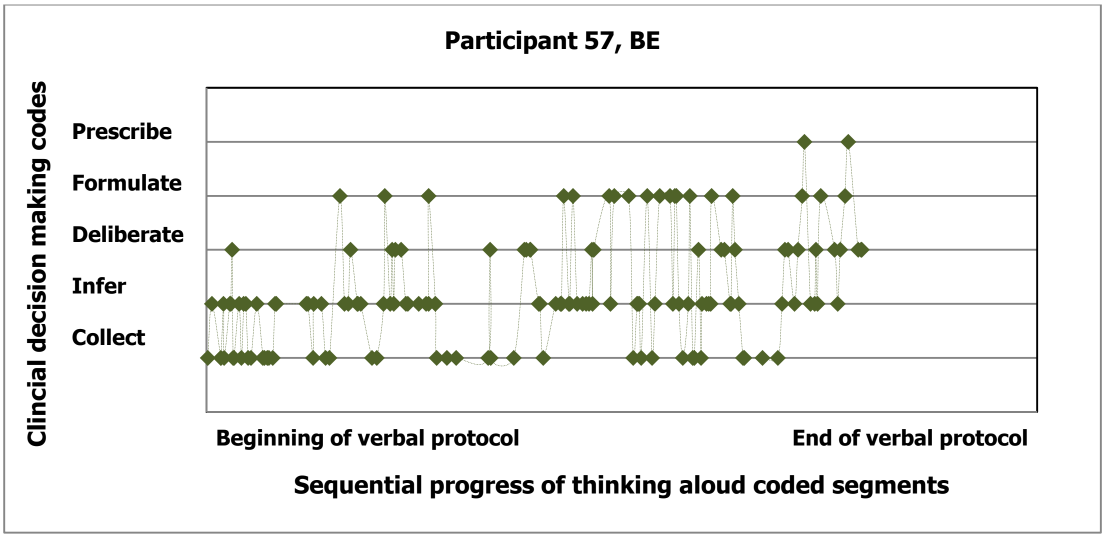
Collect
Beginning of verbal protocol
End of verbal protocol
Sequential progression of thinking aloud coded segments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Clincial decision making codes
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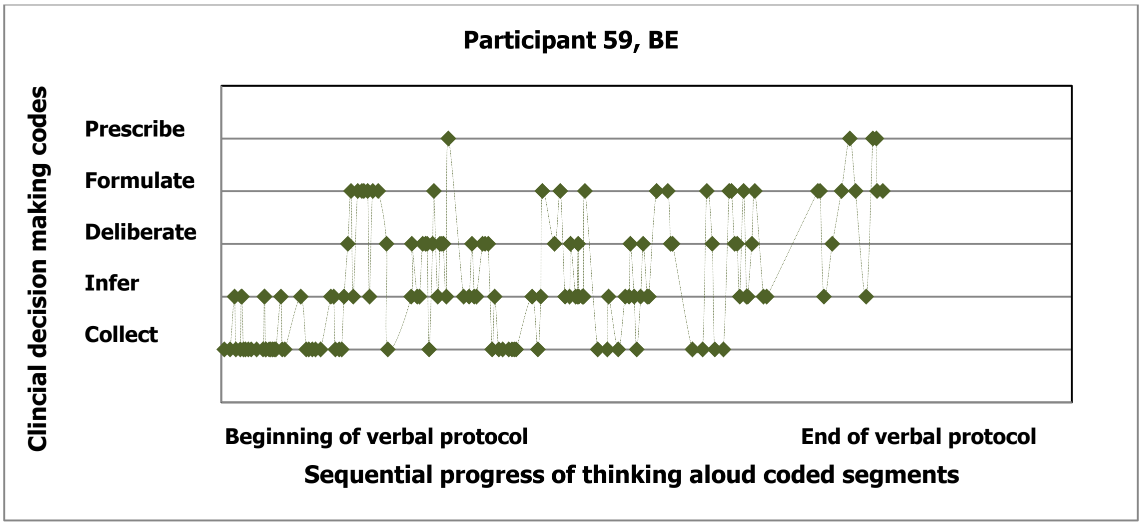
Formulate
Deliberate
Infer
Collect
Beginning of verbal protocol
End of verbal protocol
Sequential progress of thinking aloud coded segments


Participant 59, BE
Clincial decision making codes
Prescribe
Formulate
Deliberate
Infer
Collect
Beginning of verbal protocol
End of verbal protocol
Sequential progress of thinking aloud coded segments

APPENDIX 14

Example of Local Care Pathway

West Midlands NHS

Augmentative and Alternative Communication Care Pathway

Assessment and Implementation Documentation

For any advice and if you are using this document, please contact ACT on 0121 472 0754 to register the client.

Lines open MWF 9am to 4pm

This should be done even if you are not anticipating referring the person to ACT.

Please tick when this has been done ☐

Write the care pathway number here ☐

This documentation should be completed by the multidisciplinary team and client over a period of time and NOT attempted in one sitting.

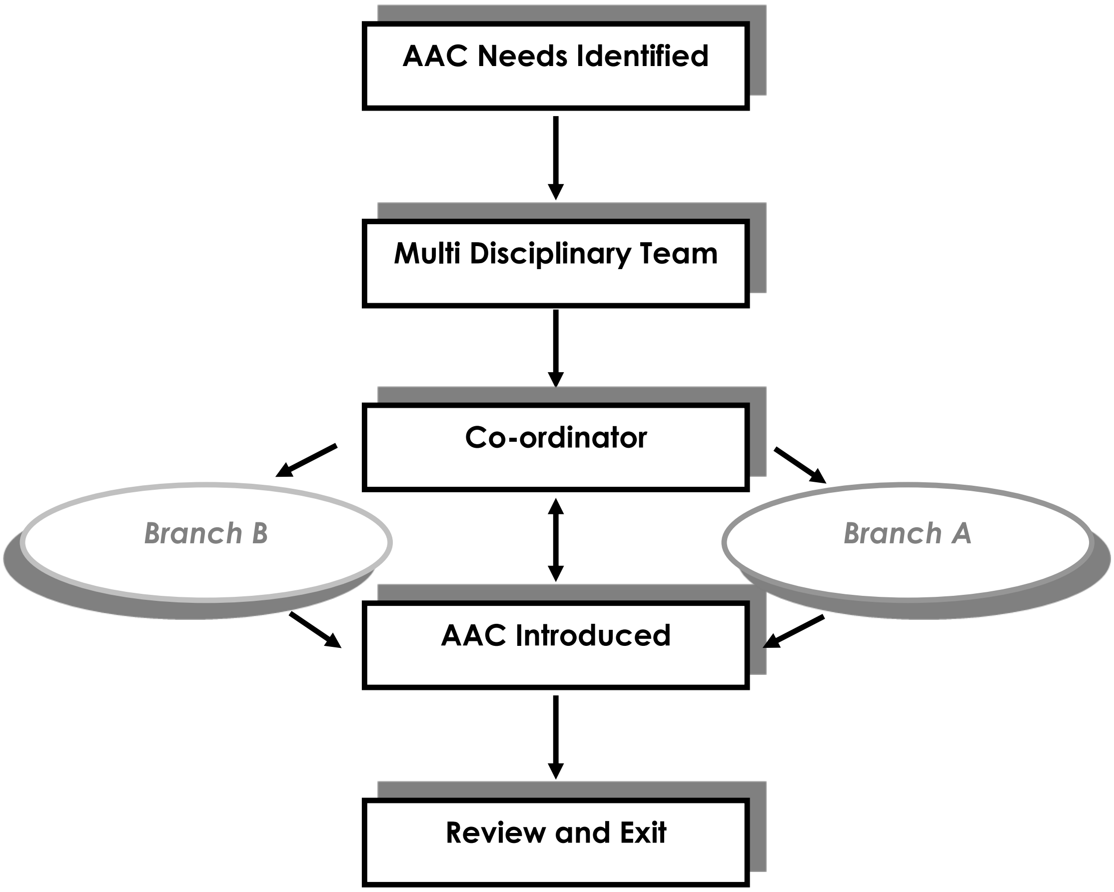
This document is not meant to be used primarily as a referral to ACT it is to support the delivery of equitable and high quality AAC intervention across the West Midlands. At any time in the process, including to register the client, get support or make a referral please contact the ACT duty referral and helpline. More information www.bhamcommunity.nhs.uk/act

Version 6 August 2013

Philosophy

The West Midlands AAC Care Pathway document has been developed as a means of gathering information over time from a range of sources.

The document is living document that will be added to over time by the client and their team in order capture change and the progression through the assessment and implementation of Augmentative and Alternative Communication (AAC)



The document should prompt team members to gain support from a variety of sources information about all of these can be found on the ACT website. In 2012 the West Midlands Augmentative and Alternative Communication Special Interest Group also developed a more detailed flow chart to add to this document which is intended to support you to see how to implement the pathway. This was added to the documentation to make version 6. The flow chart is at the end of this document. Please also make use of the referral and helpline in Access to Communication and Technology.

- **ACT referral and helpline – 0121 472 0754 Monday, Wednesday and Friday 9am to 4pm**

- **Local AAC specialist**

- **West Midlands AAC Care Pathway Special Interest Group**
- **AAC Care Pathway training**
- **ACT website**

Contents
Page number not included as these will change if completing the form electronically

- **Goals**
- **Personal Information**
- **Identification of multi-disciplinary team members; including co-ordinator**
- **Background information**
- **Communication**
- **AAC environments**
- **Use of communication**
- **Understanding of communication**
- **Equipment and positioning**
- **Implementation checklist**
- **Actions checklist**
- **Review form**
- **Recording variances**

Goals

Please define the person's long term goals for AAC (or, if appropriate, what are the goals defined by the team around the client and their advocates?).

What does this person need to be able to communicate, which they are unable to currently?

____

____

Are you able to break this down into sub sections or stages / short term goals? Please include existing goal setting systems e.g. EKOS that are useful to you and include details.

Please relate these goals to the actions you now take when using the rest of the documentation. See the Goals Checklist at the end of the document.

Consent

Has consent been obtained for

- Assessment of AAC needs
- The completion of this document
- For referral to ACT or other agencies

Yes / No (delete as appropriate)

If no please given reason:

Personal Information

Please refer to page 2 of the Documentation Guide for help on filling in this section

Surname:	First Names:	
Known as:		
Date of Birth:	Telephone No:	
Gender:	NHS No:	
Main Language: Other Language(s):	Religion:	
Other ID number:	Pathway ID (if applicable):	
Ethnic Origin: (see coding below)		
Interpreter required? (please state language)		
Full Home Address: (and current address if different)		
Postcode:		
Brief Diagnosis:		
Date of commencement of use of the documentation:		

White
A – British
B – Irish
C – Any other White background

Asian or Asian British
H – Indian
J – Pakistani
K – Bangladeshi
background
L – Any other Asian background

Other ethnic groups
R – Chinese
S – Any other group

Mixed
D – White and Black Caribbean
E – White and Black African
F – White and Asian
G – Any other mixed background

Black or Black British
M – Caribbean
N – African
P – Any other Black

If not stated
Z – If not stated

Next of Kin/Carer's Name: Relationship (e.g. spouse, parent)	
Is this person a Looked After Child? Y / N (If yes please put contact details of the person who is legally responsible for this child).	
Telephone No:	
Full Address:	
GP's Name:	
Tel. No:	
GP Address:	
Consultant's Name (if known to one):	
Funding Authority (if known):	

Names of family members / carers who should be involved in assessments / meeting.

Name	Contact details	Preferred days

Type of Residence (You may tick more than one)

Living with Family: ☐ Living in own home: ☐ In independent sector residential home: ☐ Who owns the Property?	In adult placement scheme: ☐ In supported lodgings: ☐ In private sector nursing home: ☐
Other (please state):	

Establishments Currently Attended (e.g. day centre / school)

Contact details	Type of Establishment	Days of weeks attended

Is an advocate involved?

Identification of Multi-disciplinary Team Members

Please refer to page 3 of the Documentation Guide for help on filling in this section

Team members whose involvement is agreed:			
Name	**Role**	**Contact Details / days worked**	**Tick if attendance at meetings assessments is essential**

Allocation of Co-ordinator

(Co-ordinator Details)

Please refer to page 3 of the Documentation Guide for help on filling in this section

Name of Co-ordinator:
Job Role:
Address:
Telephone No:
Fax:
E-mail:
Date Co-ordinator role starts:
Relationship to person with AAC needs:

Background Information (Please refer to page 3 of the Documentation Guide)

Medical Information **Is there a medical condition and medication that may impact on this person's functioning?**		
Impairments impacting on communication, e.g. physical, hearing, vision, memory		Date & Initials
Describe the person's level of attention, e.g. what distracts them in different situations?		
General functioning **Descriptive levels of alertness & the impact of fatigue / tiring on functioning.**		
Personality/Behaviour		
What motivates this person to communicate?		

What level of literacy does this person have? How much can s/he read e.g. recognises some words, reads simple instructions, reads and understands newspaper. How well is s/he able to spell?		
What experience does this person have of using a computer?		

Communication

Please refer to page 5 of the Documentation Guide for help on filling in this section

What are the person's present modes of communication and how effective are they? You may wish to make a note of the ratings for different environments if they differ.

1 – Ineffective 2 – partially effective 3 – mostly effective
4 – Very effective

Mode	Rating	Client's preferred method 1-least 4-most preferred		

Facial Expression				

Describe in detail e.g. how / when this is used.				
Eye Contact				
Describe in detail e.g. how / when this is used.				
Pointing e.g. hand / eye / other body part				
Describe in detail e.g. how / when this is used.				
Gesture & body language				
Describe in detail e.g. how / when this is used.				
Signing				
Describe in detail e.g. how / when this is used.				
Vocalisation				
Describe in detail e.g. how / when this is used.				
Speech				
Describe in detail e.g. how / when this is used.				
Objects				
Describe in detail e.g. how / when this is used.				

Picture, photos, symbols				
Describe in detail e.g. how / when this is used.				
Spelling chart / text / writing				
Describe in detail e.g. how / when this is used.				
VOCA				
Describe in detail e.g. how / when this is used.				
Other – please give detail				
Describe in detail e.g. how / when this is used.				

AAC Environments

In this section please consider all environments accessed by this person e.g. home, hospital, school, respite, day centre. You may wish to use a separate sheet for each environment.

Please refer to page 7 of the Documentation Guide for help on filling in this section

Do you have access to producing low tech AAC resources (digital camera / symbol software etc)?	
What support is available in this person's environment to produce symbols?	

What do staff/carers know / understand about:

Total Communication Environment	**Date & initials**
Objects of reference	

Signing	
Symbols	
Text/spelling/literacy	
Voice output communication aid (VOCA)	
Access methods (e.g. simple switching / partner assisted scanning)	

Communication Environment: What are the skills and needs of those around the client for optimising communication? How do staff / carers communicate with this person?

Use of Communication

Please use this section to describe how this person uses their modes of communication to meet the following communicative functions. Give detail of mode, client's length of communication utterance, effectiveness, frequency of use, likely setting/prompts (environmental issues) and communication partner issues.
Please refer to page 10 of the Documentation Guide for help on filling in this section

Use additional sheets in necessary	
Functions of communication • Social conventions • To request – object / action / information / clarification • To obtain attention • To confirm / deny • To give information • To clarify / repair misunderstandings • To express self • To question • To refuse	

Please include / attach details of any formal assessment – results / interpretation of results / date they were carried out.	

Understanding of Communication

Please use this section to describe how this person understands information presented to them by detailing:
Modes – symbol / sign / text / photo / object / speech
Length of information – a single key concept → complex spoken / written sentence
Impact of environment / communication partner – distractions / time allowed / clues from context etc.

Please include / attach details of any formal assessment – results / interpretation of results / date they were carried out.
Please refer to page 10-11 of the Documentation Guide for help on filling in this section

Use additional sheets in necessary	

Equipment and Positioning

Please give as much information as possible if you answer 'Yes' to any of the questions. It will be useful to carry out **observations** of the client and involve Physiotherapy / Occupational therapy / other team members. Base your comments on observation of this person **at rest** and **during activities**.

Please refer to page 11 of the Documentation Guide for help on filling in this section

Physical and Sensory

Date / initial

Please describe this person's level of mobility- are they fully mobile/ able to walk with support/ use a wheelchair the majority of the time? Etc.	

Control of movement: Please describe what *voluntary* movement the client has at the following sites:

Eyes			
Head / Chin			
Arms	**Left**	**Right**	
Hands	**Left**	**Right**	
Trunk			
Legs / feet	**Left**	**Right**	

Control of movement: Please describe what *involuntary* movement the client has at the following sites:

Eyes		

Head / Chin			
Arms	**Left**	**Right**	
Hands	**Left**	**Right**	
Trunk			
Legs / feet	**Left**	**Right**	
Do the involuntary movements increase at times during the day? **Comment on whether the movements are affected by changes in the person's environments, activities, fatigue and mood.**			
Are there times in the day that the person appears to be more relaxed? **Comment on what is happening in the environment or what the person is doing when they are more relaxed.**			

Are there movements that you think the person could use to access AAC that could be discussed with Physios or OTs? **Comment on what they are.**	
What methods of access have already been tried with this client?	

Please consider the clients hearing / vision and how any issues may impact on day to day functioning:

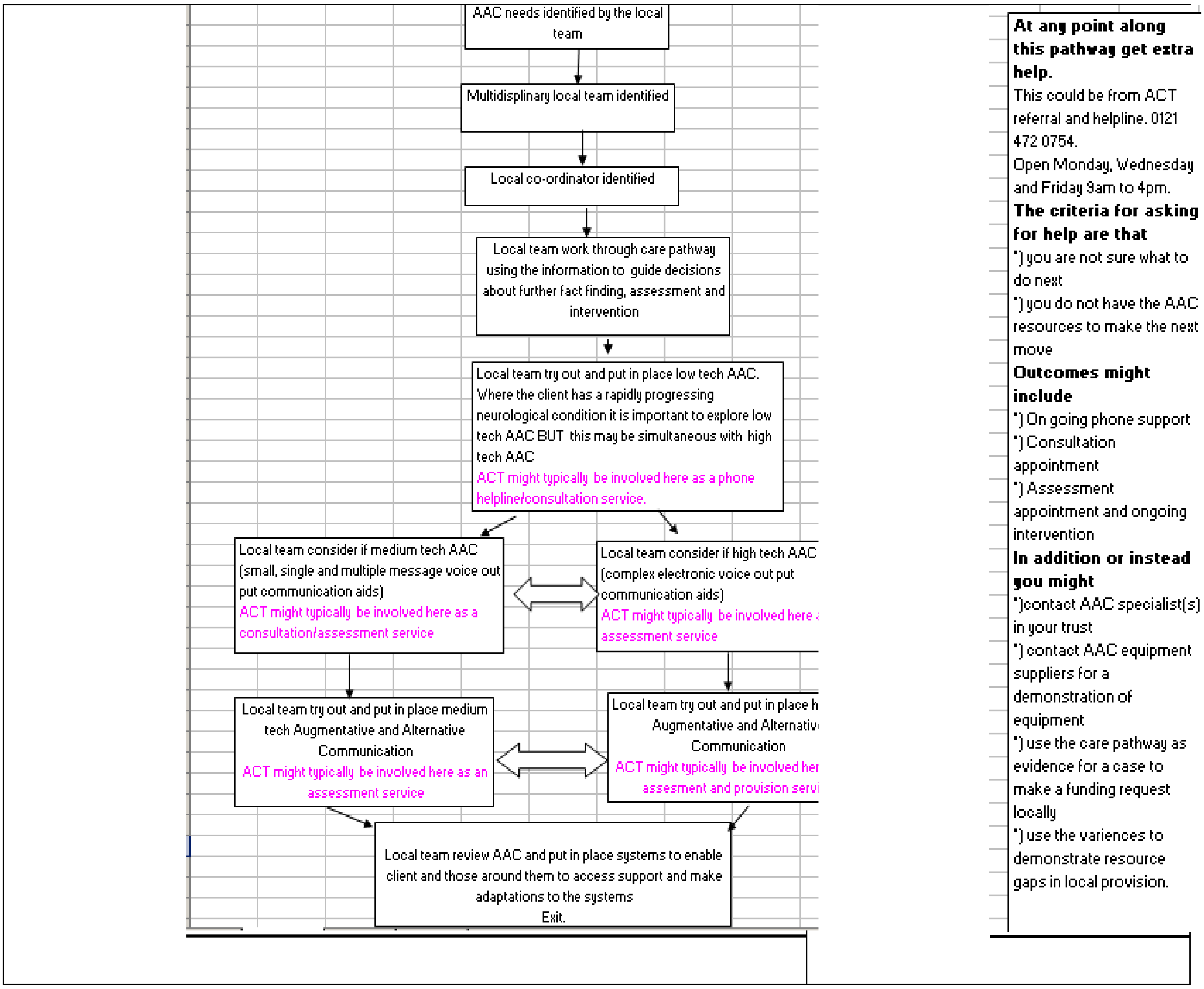
Vision (short sightedness, double vision, hemianopia)		
Hearing (uses hearing aids, has a cochlear implant)		

Does the person use different pieces of equipment (seating systems, standing frames) to assist their positioning?
Comment below on what equipment the person uses and any impact it has on their functioning.

Equipment	Description	Impact on Movement	Date and initial
Manual Wheelchair			
Tray			

Supportive Seating			
Foot plates			
Powered chair (EPIC or EPIOC)			
Head Rest			
Harness			
Standing Frame			
Other			

Implementation Checklist and flow chart



Please refer to page 12 of the Documentation Guide for help on filling in this section

Has a low tech system been identified and provided? *(please give details)*	**Action No.**
Has a high tech system been identified and provided? *(please give detail)*	**Action No.**
How is the AAC system being implemented?	**Action No.**

Is training required? *(if so, please give detail)*	**Action No.**
Review date set:	**Action No.**

<u>Co-ordinator's Checklist</u>

Please refer to page 14 of the Documentation Guide for help on filling in this section

The Co-ordinator is responsible for checking that each process of this checklist is followed.	**Action**
Has the background Information been filled in?	
Have you got contact details of everyone that is involved with the client?	
Have you informed everyone that you are the Co-ordinator?	
Are there areas of further assessment or intervention required?	
Is referral to another professional required to complete assessment or intervention?	
Is referral to another agency required?	
Is there a shared understanding of the needs and purpose of AAC?	
Are there any risks associated with this person and their environment that will influence choices made around AAC?	

<u>Actions Checklist</u>

Please refer to page 14 of the Documentation Guide for help on filling in this section

Action	What needs to be done?	Who is going to carry out the action?	

<u>Goals Checklist</u>

Please refer to page 15 of the Documentation Guide for help on filling in this section

	What needs to be done?	**Who is going to carry out the action?**	**Outcome**

Review Form,

Use this to record meetings of the multi disciplinary team in order to move the process forwards. Copy for each meeting held.

Please refer to page 15 of the Documentation Guide for help on filling in this section

Date of MDT meeting	
List of Attendees	
Progress made related to targets	
Problems Arising	
Outcomes	
Planned Actions *(note on action sheet)*	

Planned date of next meeting:

Recording Variances

Variances are situations when it has not been possible to complete the documentation or follow the Care Pathway as expected. Please record them in the table below:

Please refer to page 15 of the Documentation Guide for help on filling in this section

Variance	Reason for this	

Appendix 15

Screenshots of Process and Content Coding from NVivo (CD)

Appendix 16

Definitions for Biomedical Engineer, Clinical Scientist, Clinical Technologist and Rehabilitation Engineer

i. Definition from the HCPC

A **clinical scientist** oversees specialist tests for diagnosing and managing disease. They advise doctors on tests and interpreting data and carry out research to understand diseases.

ii. Definitions from the Institute of Physics and Engineering in Medicine

Biomedical engineers design and test the tools and equipment that medical specialists use to carry out these, and many other, complex new procedures. They also have an important role in research and development.

Clinical technologists (also known as medical technologists) are responsible for maintaining, monitoring and sometimes operating the increasingly sophisticated equipment and instruments used to diagnose illness and to treat patients.

iii. Definition from NHS Careers

Rehabilitation engineers are part of the rehabilitation team and play a key role in the assessment of the individual needs of disabled people and in the prescription of assistive technology to meet those needs. Provision of standard and custom-made assistive technology including special seating, wheelchairs, artificial limbs, electronic communicators (such as speech synthesisers) and robotic aids.